# Final - Rev. 002
# Quality Assurance Project Plan for the Lower Hackensack River Site Inspection Bergen and Hudson Counties New Jersey

**Contract No. W912DQ-13-D-3014**
**Task Order No.: 009**

**June 1, 2016**

**Prepared for:**

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Region 2
290 Broadway
New York, New York 10007-1866

**and**

**U.S. ARMY CORPS OF ENGINEERS**
**KANSAS CITY DISTRICT**
635 Federal Building
601 East 12th St
Kansas City, Missouri 64106-2894

**Prepared by:**

**CTI and Associates, Inc.**
**28001 Cabot Drive, Ste. 250**
**Novi, MI 48377**

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# Appendices

**List of Acronyms**

| | |
|---|---|
| ARARs | Applicable or Relevant and Appropriate Requirements |
| BS/BSD | Blank Spike/Blank Spike Duplicate |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CCB | Continuing Calibration Blank |
| COC | Chain-of-custody |
| COPC | Compounds of Potential Concern |
| CPR | Cardiopulmonary Resuscitation |
| CRQL | Contract Required Quantitation Limit |
| CSGov | Computer Sciences Government Services |
| CSC | Computer Sciences Corporation |
| CTI | CTI and Associates, Inc. |
| DESA | Division of Environmental Science and Assessment |
| DQI | Data Quality Indicators |
| DMC | Deuterated Monitoring Compounds |
| EDD | Electronic Data Deliverable |
| EEE | 3E Consulting, Inc. |
| E4 | E4 Sciences |
| FTL | Field Team Leader |
| FSP | Field Sampling Plan |
| GPS | Global Positioning Satellite |
| HMD | Hackensack Meadowlands District |
| HAZWOPER | Hazardous Waste Operations and Emergency Response Standard |
| H&S | Health & Safety Audit |
| HRS | Hazard Ranking System |
| IBC | Initial Calibration Blank |
| J | Estimated Value |
| LCS | Laboratory Control Samples |
| LHR | Lower Hackensack River |
| LOD/LOQ | Limit of Detection / Limit of Quantification |
| PA | Preliminary Assessment |
| PAL | Project Action Limit |
| Pdf | Portable Document Format |
| PM | Project Manager |
| mg/kg | milligram per kilogram |
| MS | Matrix Spike |
| MS/MSD | Matrix Spike / Matrix Spike Duplicate |
| MDL | Method Detection Limit |
| NOAA | National Oceanic & Atmospheric Administration |
| NPL | National Priorities List |
| NA | Not Applicable |
| PCB | Polychlorinated Biphenyl |
| QA | Quality Assurance |
| QC | Quality Control |
| QL | Quantitation Limits |
| RCRA | Resource Conservation and Recovery Act |
| RM | River Mile |
| RPD | Relative Percent Difference |

**List of Acronyms - Continued**

| | |
|---|---|
| RRF | Relative Response Factor |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| SI | Site Inspection |
| SOP | Standard Operating Procedure |
| SVOCs | Semi-volatile Organic Compound |
| SOW | Statement of Work |
| TAL | Target Analyte List |
| TCL | Target Compound List |
| TOC | Total Organic Compound |
| USACE | United States Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| UFP-QAPP | Uniform Federal Policy-Quality Assurance Project Plan |
| VOCs | Volatile Organic Compounds |

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# INTRODUCTION

## Site Overview

This document is the Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) for the Site Inspection (SI) for the Lower Hackensack River (LHR) in Bergen and Hudson counties, New Jersey (Site ID No: NJN00201845). CTI and Associates, Inc., (CTI) was tasked by the United States Army Corps of Engineers (USACE) and the United States Environmental Protection Agency (USEPA) to provide technical support for completion of the LHR SI. CTI will conduct the SI activities under USACE Kansas City District Contract Number W912DQ-13-D-3014, Task Order Number 009. This UFP-QAPP presents a sampling design and rationale as well as the quality assurance (QA) and quality control (QC) procedures to be followed for the surface and subsurface sediment sampling of the LHR. This UFP-QAPP also includes the Field Sampling Plan (FSP) (**Appendix A**).

The LHR Preliminary Assessment (PA), completed in September 2015, identified contaminated sediments extending from approximately south of the Overpeck Creek tributary to the mouth of the Hackensack River based on the environmental data repository compiled by the National Oceanic & Atmospheric Administration (NOAA). The EPA SI process is intended to evaluate actual or potential environmental hazards at a particular site relative to other sites across the nation for the purpose of identifying remedial action priorities. The SI, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), is intended to collect sufficient data to enable evaluation of a site's potential for inclusion on the National Priorities List (NPL) and establish priorities for additional action, if warranted. The decision as to whether a site is placed on the NPL is made based on the EPA's Hazard Ranking System (HRS) criteria. The HRS assesses the relative threat to human health and the environment associated with the actual or potential releases of hazardous substances at a site. This UFP-QAPP, and hence, the SI process, is not intended to include extensive or complete site characterization, contaminant fate determination, or quantitative risk assessment.

## Location and Description

The LHR SI Study Area is defined in the Hackensack River PA as the portion of the LHR located between the Oradell Dam (River Mile [RM] 23.3) and the mouth of the river in Newark Bay (RM 0.0). The Hackensack River is approximately 45 miles long, originating at Lake Lucille in New City Rockland County, New York, and empties into Newark Bay, New Jersey. The portion of the LHR undergoing this SI is located between the Oradell Dam (RM 23.3) and the mouth of the river in Newark Bay (RM 0.0). The river miles shown on **Figure 1-1** and all subsequent FSP figures are based on published Hackensack River miles (33 CFR §117). This section of the river includes the Hackensack Meadowlands District (HMD), a 5,445-acre estuarine emergent wetland (half of the total wetland/pond acreage along the Hackensack River) located just a few miles north of Newark Bay. There are 17 named tributaries to the LHR below the Oradell Dam shown on **Figure 1-1.**

### Land Use

Current land uses in the northern section of the study area, north of the HMD, generally follow suburban development patterns characterized by low densities, larger lot sizes, and winding streets with cul-de-sacs. Land uses in the northern part of the study area primarily consist of

residential, commercial, and public. Land uses along the LHR in the lower section of the study area consist primarily of industrial, open space wetlands/forested, and public with some residential and some commercial land surrounding the HMD. Over the entire study area, residential is the largest percentage of land use, followed by public land and industrial land.

## QAPP Worksheet #1 & 2 – Title and Approval Page

| | |
|---|---|
| **Site Name/Project Name:** | QAPP for the Lower Hackensack River Site Inspection |
| **CERCLIS ID Number:** | NJN000201845 |
| **Contractor Name:** | CTI |
| **Contract Title:** | SATOC For Environmental Consulting Services |
| **Task Order Number:** | W912DQ-13-D-3014 TO 009 |

**Lead Organization:** USEPA Region 2
**Oversight Organization:** USACE Kansas City District
**Investigative Organization:** CTI

Investigative Organization's Program Manager: Christopher Winkeljohn, PE

Signature and Date
CHRISTOPHER F. WINKELJOHN CTI & ASSOCIATES
Printed Name/Organization

Investigative Organization's QA Manager: Jeffery Cange, PG

8 JUNE 2016
Signature and Date
Jeffery Cange CTI & Associates
Printed Name/Organization

Investigative Organization's Project Manager: Matthew Jerue, PE

02 JUNE 2016
Signature and Date
Matthew D. Jerue, CTI and Associates
Printed Name/Organization

Oversight Organization Project Manager: Jacqueline Frazer

14 June 2016
Signature and Date
Jacqueline Frazier, USACE
Printed Name/Organization

Lead Organization Remedial Project Manager: Ildefonso Acosta

14 June 2016
Signature and Date
ILDEFONSO ACOSTA, USEPA
Printed Name/Organization

Lead Organization Quality Assurance Officer: Sergio Lopez-Luna, PE

14 June 2016
Signature and Date
Sergio Lopez-Luna, P.E., USEPA Region 2
Printed Name/Organization

List organizational partners (stakeholders) and connection with lead organization:

- EPA Region 2 Superfund Program – Lead Agency
- USACE Kansas City District – Oversee Contractor and Support USEPA
- New Jersey Department of Environmental Protection – Regulatory Agency

1. Identify guidance used to prepare QAPP:

- Uniform Federal Policy for Quality Assurance Project Plans (USEPA, Final Version 1, March 2005)
- Uniform Federal Policy for Quality Assurance Project Plans Optimized UFP-QAPP Worksheets (Intergovernmental Data Quality Task Force, March 2012)

2. Identify regulatory programs:

   CERCLA

3. Identify approval entity:

   USEPA Region 2

   USACE – Kansas City District

4. This is a project-specific QAPP.

5. List dates of scoping sessions that were held:

   Site Visit / Lower Hackensack River Boat Tour: March 10, 2016

   CSGov Technical Assistance Teleconference: March 11, 2016

6. List dates and titles of QAPP documents written for previous site work – Not Applicable

7. List organizational partners (stakeholders) and connection with lead organization:

   USEPA – Lead Regulator

   NJDEP – State Regulator

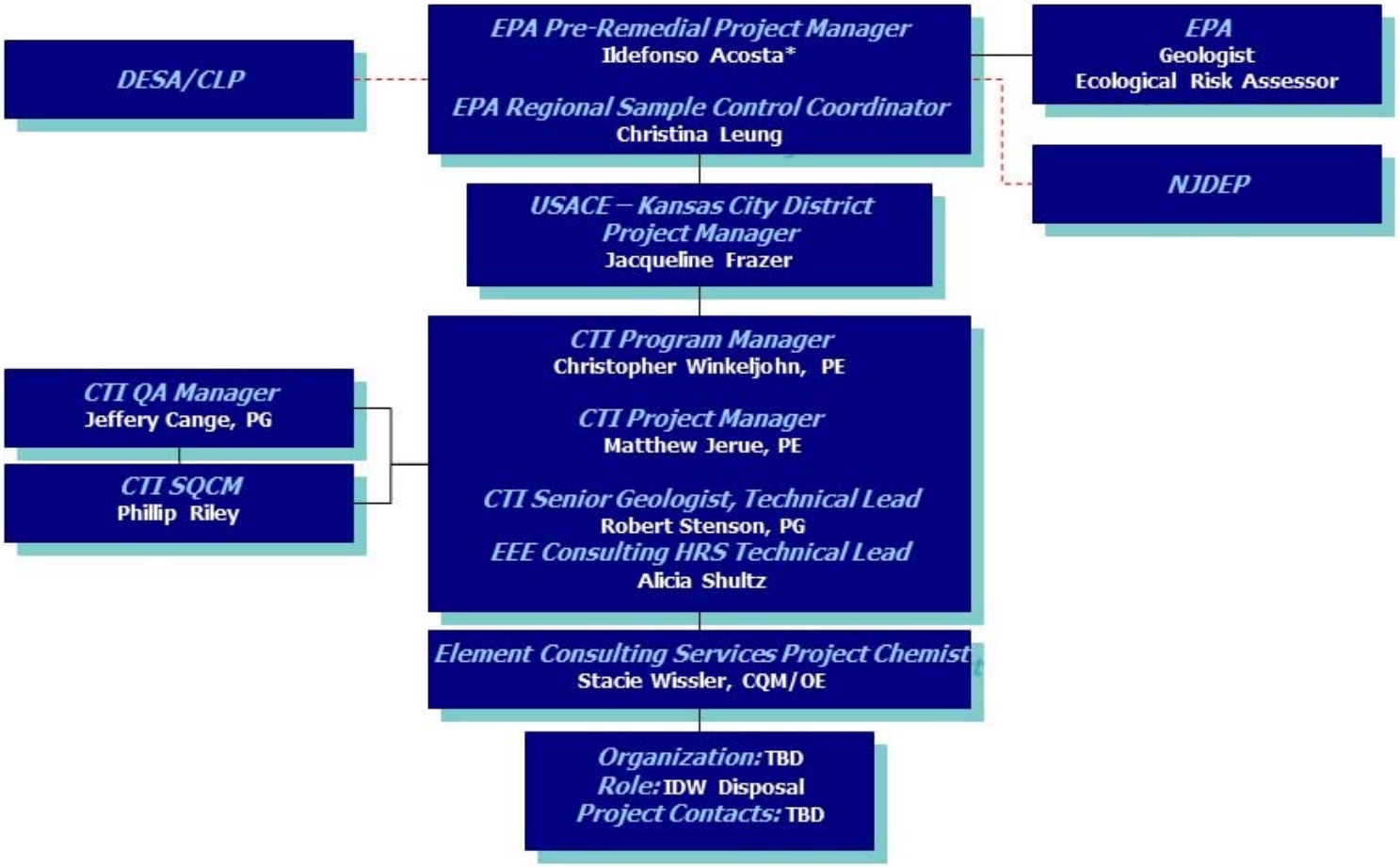
8. List data users:

   USEPA, USACE, NJDEP, and CTI

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. An explanation for their exclusion is included on the following table:

   Not applicable (N/A)

## QAPP Worksheet #3 – Project Organization




* - QAPP recipient

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## QAPP Worksheet #5 – QAPP Distribution

| QAPP Recipients | Title | Organization | Telephone Number | Cell Number | E-mail Address | Document Control Number |
|---|---|---|---|---|---|---|
| Ildefonso Acosta | NPL Coordinator | EPA Region 2 | (212) 637-4344 | | Acosta.Ildefonso@epa.gov | June 1, 2016, Rev 002 |
| Sergio Lopez-Luna, PE | Technical Reviewer | DESA/CLP | (732) 321-6778 | | | June 1, 2016, Rev 002 |
| Jacqueline Frazier | Project Manager | USACE | (816) 389-3277 | (913) 306-7779 | Jacqueline.G.Frazier@usace.army.mil | June 1, 2016, Rev 002 |
| Andrew Gosnell | Technical Lead | USACE | (816) 389-3891 | | Andrew.S.Gosnell@usace.army.mil | June 1, 2016, Rev 002 |
| Chris Winkeljohn, PE | Program Manager | CTI | | (248) 770-5790 | cwinkeljohn@cticompanies.com | June 1, 2016, Rev 002 |
| Matthew Jerue, PE | Project Manager | CTI | (248) 560-0709 | (248) 787-4087 | mjerue@cticompanies.com | June 1, 2016, Rev 002 |
| Robert Stenson, PG | Technical Lead | CTI | (920) 482-3902 | (414) 617-0647 | rstenson@cticompanies.com | June 1, 2016, Rev 002 |
| Jeffery Cange, PG | Quality Control System Manager | CTI | | (865) 803-3979 | jcange@cticompanies.com | June 1, 2016, Rev 002 |
| Alicia Shultz | SI Technical Lead | EEE Consultants | | (518) 817-2783 | ashultz@nycap.rr.com | June 1, 2016, Rev 002 |
| Stacie Wissler, CQM/OE | Project Chemist | Element Consulting Services | | (619) 920-6063 | swissler@elementinc.net | June 1, 2016, Rev 002 |
| Joseph Brown, CIH | Safety / Health Manager | CTI | | (863) 963-2118 | jbrown@cticompanies.com | June 1, 2016, Rev 002 |
| Phillip Riley | Field Team Leader (FTL) | CTI | | (248) 787-4057 | priley@cticompanies.com | June 1, 2016, Rev 002 |

## QAPP Worksheet #4, 7, & 8 – Personnel Qualifications and Sign-Off Sheet

This table is used to identify key project personnel for each organization performing tasks defined in this QAPP. Copies of this form will be signed by key project personnel from each organization list to indicate that they have read the applicable QAPP sections and will perform the tasks as described. Each organization should forward the signed sheets to the central project file maintained by the CTI Project Manager. Any new personnel to the project should review and sign the sheet.

**Organization:** USEPA / USACE

**Project Personnel Qualifications and Sign-Off**

| Project Personnel | Project Title/Role | Education/Experience | Specialized Training/Certification[a] | Signature/Date |
|---|---|---|---|---|
| Ildefonso Acosta | NPL Coordinator | As required for project | As required for project | |
| Christina Leung | RSCC DESA Coordinator | As required for project | As required for project | |
| Jacqueline Frazier | Project Manager | As required for project | As required for project | |
| Andrew Gosnell | Technical Lead | As required for project | As required for project | |
| | | | | |

**Organization:** CTI

**Project Personnel Qualifications and Sign-Off**

| Project Personnel | Project Title/Role | Education/Experience | Specialized Training/Certification[a] | Signature/Date |
|---|---|---|---|---|
| Chris Winkeljohn, PE | Program Manager | B.S. Chemical Engineering. Over 25 years in environmental consulting | Professional Engineer (PE) | 14 June 2016 |
| Matthew Jerue, PE | Project Manager | B.S. Chemical and B.S Environmental Engineering. Over 35 years environmental consulting | 40-hour HAZWOPER, 8-hour Refresher, First Aid/CPR | 02 JUNE 2016 |
| Robert Stenson, PG | Technical Lead | B.S Geology and M.S. Geophysics. Over 26 years of environmental site investigation experience. | Professional Geologist – Wisconsin, Certified Professional Geologist. 40-hour HAZWOPER, 8-hour Refresher, First Aid/CPR | 10 June 2016 |
| Jeffery Cange, PG | QCSM | M.S. Geology. Over 32 years of environmental project management experience. | Professional Geologist. | 8 June 2016 |
| Alicia Shultz | SI Technical Lead | B.S. Biology. 25 years of experience | 40-hour HAZWOPER, 8-hour Refresher, First Aid/CPR, HRS Training, Site Assessment Training, wetland delineation training. | 16 June 2016 |
| Stacie Wissler, CQM/OE | Project Chemist | B.S. Biology. Over 30 years of experience | Certified Quality Manager/Operations of Excellence Certified Quality Auditor | 15 JUNE 2016 |
| Joseph Brown, CIH | Safety / Health Manager | MS Public Health, BS biology. Over 30 years in H&S consulting | CIH | 13 June 16 |
| Phillip Riley | Field Team Leader (FTL) | HS Grad with college course work. Over 25 years chemistry and environmental sampling. | 40-hour HAZWOPER, 8-hour Refresher, First Aid/CPR, and USACE CQM for Contractors | 13 June 2016 |
| | | | | |

[a] – Employees receive the following training: United States Department of Transportation hazardous materials transportation, 40-hour HAZWOPER training program and the CPR/first aid certification. Additional specialized training/certifications for project personnel are listed on the above table.

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## QAPP Worksheet #6 – Communication Pathways

The communication pathways and modes of communication that will be used during the project, after the QAPP has been approved, are listed below.

| Communication Driver | Organization/ Responsible Entity | Name | Contact Information | Procedure (timing, pathways, etc.) |
|---|---|---|---|---|
| Point of Contact with USEPA | USACE PM | Jacqueline Frazier | (816) 389-3277 | Jacqueline Frazier will be Point of Contact with USEPA and CTI |
| QA Oversight | CTI | Jeffery Cange, P.G. | (865) 803-3979 | Approve any modifications to the QAPP or field procedures. |
| Manage All Project Phases | CTI | Matthew Jerue, PE | (248) 787-4087 | Matt will coordinate with Ildefonso Acosta (EPA) and Jacqueline Frazier (USACE) and the project team (including subs) on the planning, execution and delivery of all components of the project. |
| Daily Field Reports | CTI | Phillip Riley | (248) 787-4057 | FTL will email formal daily reports to Matthew Jerue. Project Manager will forward daily reports USACE PM. |
| Field Quality Issues | CTI | Phillip Riley | (248) 787-4057 | FTL will call CTI Project Manager to discuss issues. Any corrective actions will be confirmed with EPA and USACE PMs, and QA Officer. |
| Field Adjustment Form | CTI | Phillip Riley | (248) 787-4057 | Recommended changes to the field sampling plan based on field conditions will be submitted within 24 hours to UASCE PM. USACE PM can give written or oral approval prior to implementation. |
| Communication with RSCC | CTI | Phillip Riley | (248) 787-4057 | General communication will be through Project Manager designated as Laboratory's point-of-contact for this program to the Regional Sample Control Coordinator. |
| Field Corrective Actions | CTI | Matthew Jerue, PE | (248) 787-4087 | Project Manager will determine Corrective Actions consulting with the FTL. Project Manager has stop work authority pending resolution of quality issues. Actions will be approved by USACE QA officer. |
| Release of Analytical Data from DESA/CLP | EPA Laboratory QA Officer | TBD | | EPA will release data after the appropriate validation has been successfully completed. |
| Field Sampling or QAPP Amendments | CTI | Robyn James | (248) 560-0723 | Major changes impacting scope require approval by USACE PM and contracting officer before implemented. |

## QAPP Worksheet #9 – Project Planning Session Summary

One site visit river tour of the Lower Hackensack River, one CSGov Technical Assistance Teleconference Meeting and several conference calls have been implemented for the planning phases of this project. A list of the calls completed to date is provided below.

Date of conference calls: 12 April, 2016
Date of scoping meeting: River Tour 10 March 2016 and CSGOV TA Teleconference 11 March, 2016
Purpose: Scope development and review

Participants 12 April, 2016:

| Name | Organization | Title/Role | Email/Phone |
|---|---|---|---|
| Ildefonso Acosta, | EPA | Region 2 NPL Coordinator | 212-637-4344 |
| Andy Gosnell | USACE | Project Technical Lead | 816-389-3891 |
| Matthew Jerue, P.E. | CTI | Project Manager | 248-787-4087 |
| Rob Stenson, P.G. | CTI | Project Technical Lead | 920-482-3902 |
| Jamie Dickson, P.E. | CTI | Senior Engineer | 920-560-1820 |
| Alicia Shultz, HRS/Site Assessment Specialist | EEE | HRS/Site Assessment Specialist | 518-817-2783 |
| | | | |

Consensus decisions made:

| Key Decisions/Action Items | Responsible Party | Due Date |
|---|---|---|
| The current sampling program includes 190 locations. Surface samples only will be collected at 6 of those locations, and surface and subsurface samples will be collected at 184 locations. The total number of samples (exclusive of QC/QA samples) is 374. | EPA/USACE/CTI | |
| Background locations were discussed, and included: upstream near the New Milford water treatment plant (surficial and subsurface sample); Overpeck Creek, downstream of the dam (surface and subsurface); and mouth of the Hackensack River (mile 0 to 0.5). Final selection will be based on laboratory data results. | EPA/USACE/CTI | |
| In areas where the vibra-core cannot access, CTI will utilize manual sampling methods (piston sampler) to obtain subsurface samples where necessary. | CTI | |

| Key Decisions/Action Items | Responsible Party | Due Date |
|---|---|---|
| Available E4 report and attachment information obtained since the last meeting, along with the NOAA data, has been incorporated into revised sampling locations. | CTI | |

Action Items:

| Action | Responsible Party | Due Date |
|---|---|---|
| Complete QAPP/FSP for Draft Review | CTI | |

River Tour 10 March 2016 and CSGOV TA Teleconference 11 March, 2016

| Name | Organization | Title/Role | Email/Phone |
|---|---|---|---|
| Ildefonso Acosta, | EPA | EPA Region 2 NPL Coordinator | 212-637-4344 |
| Mel Hauptman | EPA | EPA Region 2 Section Chief | 212-637-4338 |
| Dr. William Chantry | CSGov Technical Assistance | CSC Region 2 Coordinator | 703-461-2437 |
| Mary Stubblefield Clemmensen, | CSGov Technical Assistance | CSC Technical Assistance Author | 703-461-2109 |
| Jacqueline G. Frazier | USACE | Project Manager | 816-389-3277 |
| Andy Gosnell | USACE | Project Technical Lead | 816-389-3891 |
| Matthew Jerue, P.E. | CTI | Project Manager | 248-787-4087 |
| Rob Stenson, P.G. | CTI | Project Technical Lead | 920-482-3902 |
| Alicia Shultz, HRS/Site Assessment Specialist | EEE | HRS/Site Assessment Specialist | 518-817-2783 |
| Donna Davies, Site Assessment Specialist | EEE | Site Assessment Quality Assurance Specialist | 484-663-1043 |

Consensus decisions made:

| Key Decisions/Action Items | Responsible Party | Due Date |
|---|---|---|
| During the site reconnaissance completed on March 10, 2016 and following the CSC technical assistance (TA) call on March 11, 2016, EPA Region 2, CTI, and EEE discussed the following issues related to the upcoming sampling event and HRS package preparation.<br>• Background and release samples will be collected from similar depositional environments and are expected to have a similar matrix.<br>• Potential background sampling locations identified include six locations from upper reaches of the Hackensack River, Overpeck Creek, and Newark bay at Hackensack Flats | EPA/USACE/CTI | |

| Key Decisions/Action Items | Responsible Party | Due Date |
|---|---|---|
| • Background sampling locations observed to be tidally influenced. *(See note above regarding Overpeck Creek)*<br>• Background samples will be collected from three depths, surface and center and bottom of core.<br>• 500 sediment samples will be collected from 250 individual sampling locations. A surface sediment will be collected using a Ponar sediment grab and one subsurface sediment sample will be collected from a 10-foot by vibra-core per location (Pontoon Boat). A sample will be collected from the interval with visual evidence of contamination or field screening. If no contaminated is noted, the sample will be collected at the bottom of the interval.<br>• Upstream of Route 4 Bridge inaccessible by vibra-core vessel, only surface Ponar sediment samples will be collected (Jon Boat). The number of samples collected in this river section may be reduced and integrated into the downstream sample location strategy.<br>• Excess sediment remaining after sample collection will be returned to the river; no sediment will be retained as IDW.<br>• Sample locations will be identified to focus sample effort in fine grained depositional environments.<br>• A sediment sample will be collected at the mouth of every tributary (20).<br>• Sampling in river backwaters or tributaries will not be performed.<br>• Approximately eight discrete samples will be collected per day during the duration of the seven week field investigation.<br>• Approximately 272 sediment containers will be required each day. This number does not include duplicate samples, MS/MSD samples, or field/equipment rinsate blank samples.<br>• Target Areas include wetlands, fishery, and essential fish habitat.<br>• Decision regarding if DESA or CLP laboratory will be used and for which parameters is time critical for development of the UFP-QAPP. A conference call between EPA, DESA, and CTI/EEE will be scheduled for early the week of March 14.<br>• It may be helpful to submit weekly requests for analysis which will result in receipt of analytical data packages over time to allow for on-going data evaluation.<br>• CTI will submit weekly field trip reports to correspond with each week's sample activity.<br>• EPA UFP-QAPP / FSP document review cycle is assumed to be 15 working days; but may be expedited.<br>• It would be extremely helpful if the sediment analysis is reported by the laboratory as dry weight concentration.<br>• EEE noted that the PA only evaluated the surface water migration pathway and requested that only the surface water migration pathway be evaluated in the SI report. EPA will determine if this will be acceptable and notify EEE.<br>• The specific laboratory analysis required was discussed. It was agreed that the samples would be analyzed for total organic content, grain size, metals, mercury and PCBs. The pros and cons of analyzing for volatile organic compounds (VOCs), all semi-volatile organic compounds SVOCs (possibly not analyze for pesticides/herbicides), and dioxins/furans was discussed. EPA will make a decision regarding what additional analysis will be required and notify CTI.<br>• EPA and EPA's HRS technical assistance team will be consulted during development of HRS package which should result in minor technical review comments. Minor technical comments include those | | |

| Key Decisions/Action Items | Responsible Party | Due Date |
|---|---|---|
| comments that do not change the basic scoring strategy and include the source, targets, attribution or background locations and concentrations.<br>The HRS scoring strategy is to document a commingled sediment plume with no identifiable source. | | |

Action Items:

| Action | Responsible Party | Due Date |
|---|---|---|
| • Determine if DESA or CLP laboratory will be used and for which parameters.<br>• Determine if VOCs, pesticides/herbicides and/or dioxins/furans analysis will be performed.<br>• Provide CTI a copy of the Upper Duwamish HRS documentation record. | EPA | |

## QAPP Worksheet #10 – Conceptual Site Model

### Summary of Existing Site Conditions

The geomorphology varies greatly over the length of the Lower Hackensack River. The thalwegs of the river range from -10 to -70ft in depth and observations show that the thalwegs have maintained themselves for over 100 years. The river flats vary from nonexistent in some bends to a broad gradation across the width of the river, particularly in the upper reaches. The Hackensack Meadowlands District (HMD) is a 5,445-acre estuarine emergent wetland with ebb-flow funnels into the main river channel. The channel bottom shows scouring features, ebb-flow tidal deltas, and flood sand waves typically associated with coarser grained river deposits. The fine grained depositional sections of the river (point bars, subtidal and tidal flats, etc.) extend from the river's mouth to the Oradell Dam. Throughout the Lower Hackensack River, the sediments, sedimentation rate, and sedimentary structures vary strongly and locally. Ebb and flood tidal currents control the sedimentary morphology in the riverine estuary. The Holocene sedimentation rate is low, as sediment continually moves in the river. Exceptions are in a few areas of higher deposition that are leeward of the tidal flux.

Based on review of environmental data repository compiled by the NOAA for the Lower Hackensack River, the September 2015 PA found that cadmium, lead, mercury, 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCDD) (dioxin), benzo(a)pyrene, dibenz(a,h)anthracene, polychlorinated biphenyl (PCB) and dieldrin are present predominantly in the main stem of the river at concentrations that are expected to be significantly elevated in the lower portion of the study area relative to background concentrations.

A review of federal, state, and local environmental databases has indicated thousands of potentially contaminated sites within the Lower Hackensack River watershed that may have currently or historically impacted the river. Innumerable historic sources of contamination to the Hackensack River are expected to have existed over the river's long history of industrial and commercial use.

Documentation and investigation of associated spills, releases, and discharges to the river were not recorded as a practice until more recent times. For this reason, it is not possible to determine how these many activities may have impacted the Lower Hackensack River. Although most of the responsible sources and extent of sediment contamination is unknown; it should be noted that there are nine NPL sites and multiple Resource Conservation and Recovery Act (RCRA) facilities within the 1-mile radius of the Hackensack River or its tributaries which have similar contaminants as those found in the main stem of the Lower Hackensack River. However, due to the nature of the tidal influence on sediments, the PA found that hundreds of other existing and historical facilities along the river are likely additional sources, especially in the industrialized section of the lower river.

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## QAPP Worksheet #11 – Project/Data Quality Objectives

Worksheet 17 provides details on the sampling design and rationale.

**Who will use the data?**

USEPA, USACE, and CTI will use these data to complete the SI Report and HRS documentation.

**What will the data be used for?**

The data will be used as part of the overall SI/HRS process to characterize the nature of contaminants in surface and subsurface sediments.

The SI Field Program data will be used for the following:

The surface and subsurface sediment data will be used to:

- Characterize the physical properties and chemical nature of sediments along the length of the LHR
- Document background concentrations (the concentration of a hazardous substance that provides a defensible reference point that can be used to evaluate whether or not a release from the site has occurred) that accounts for variability in local concentrations and matrix.
- Document an observed release to surface water and level of contamination associated with targets in accordance with HRS.
- Characterize the source and estimate the volume of contaminated sediment in accordance with the HRS.
- Establish a list of compounds of potential concern (COPCs) in in the LHR sediments.
- Characterize the vertical distribution and depositional time history of constituents within the sediment profile.
- Characterize geotechnical and total organic carbon data.

**What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?**

Section 4 of the SI FSP **(QAPP Appendix A)** and Worksheet #15 provide a full list of constituents. Worksheets #20 and 23 provide the field quality control summary and analytical SOPs, respectively.

**How "good" do the data need to be in order to support the environmental decision?**

The data needs to be collected and analyzed in conformance with USEPA Region 2 QA guidance and manuals (http://www.epa.gov/region2/qa/documents.htm) and provide legally defensible analytical results supported by a high level of quality assurance and documentation.

**How much data are needed (number of samples for each analytical group, matrix, and concentration)?**

For the SI Field Program:

- Sample collection for target analytes is planned throughout the LHR Study Area.
- The number of surface and subsurface sediment samples for target analytes are planned to be sufficient to provide a broad characterization of the LHR Study Area.
- The number of surface and subsurface sediment samples for target analytes are planned to be sufficient to support the SI Report and HRS documentation.

Worksheet #20 provides a summary of estimated sample number for each matrix.

**Where, when, and how should the data be collected/generated?**

For the SI Field Program:

The proposed surface and subsurface sediment locations are presented on **Figures 3-1 thru 3-4**. LHR sample stations by river mile are presented in **Attachment A** of the SI FSP presented in QAPP **Appendix A**. Sample stations shown designate a position within a specific depositional feature on the LHR. Due to the ongoing migration of sediment deposits within the river estuarine environment, the final sample station with respect to the distance from shoreline may vary due to water depth information monitored during sample vessel positioning, tide cycle, and field location of the specific depositional feature. As a result, sample stations may be adjusted perpendicular to the shoreline to provide access to the proposed location by the sample vessel. The characterization will be used to document an observed comingled release to the river with no known source, the quantity of LHR contaminated sediment, and observed release within surface water target areas (wetlands and spawning areas critical for the maintenance of fish and migratory pathway and feeding areas critical for the maintenance of anadromous fish species).

Based on access restrictions to sections of the river due to low bridge clearance or the narrow channel in the upper section of the river (estimated to be above RM 19.0), the following sample collection strategy and sampling methods will be used for the LHR SI:

- River Mile 0.0 to 19.0: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core) per location. **(Figures 3-1 thru 3-4)**
- River Mile 19.0 to 22.0: One surface grab (Ponar/Ekman dredge) per location. **(Figure 3-4)**
- Hackensack River Tributaries, Mile 0.0 to 22.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core) per location. **(Figures 3-1 thru 3-4)**
- Background Sample Locations:
    - River Mile 22.25 to 22.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Piston Sampler) per location. Total sample locations = 4. This background location is located adjacent to the New Milford Plant of the Hackensack Water Company in the brackish water section of the Hackensack River. **(Figure 3-4)**
    - Overpeck Creek at Hackensack River RM 13.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core or Piston Sampler) per location based on access. Total sample locations = 4. These background locations are located in brackish water downstream of the Overpeck Creek dam and upstream of the Hackensack River. **(Figure 3-3)**
    - Newark Bay / Mouth of Hackensack River RM 0.0 to 0.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core) per location. Total sample locations = 4. These background locations are dual purpose samples co-located with the LHR SI surface and subsurface sediment stations. These locations will be evaluated to determine if they are representative of the LHR flood tide background location. **(Figure 3-1)**

**Who will collect and generate the data?**

As described in Worksheet #7, CTI under contract with USACE will perform the field sampling and provide the field team staff required to conduct the SI sampling, laboratory coordination and support, and other subcontractor coordination (e.g., boat crews, survey crews, etc.).

**How will the data be reported?**

Updates of locations and sample collection progress during the SI field activities will be communicated as described in Worksheet #6. Regular reporting on the progress of the SI will be performed as part of the overall monthly progress reporting and will include the following:

- Description of work conducted during the reporting period (previous month)
- Description of planned work for the next two months
- Meetings conducted during the reporting period
- Approved modifications to work plans and schedules
- Reports of sampling and tests applicable to the SI work

- USEPA validated data received during the SI program, including QA/QC information, percent of completion, and issues encountered

Following completion of the SI Field Program, the SI Report and HRS documentation package will be prepared. The SI Report will summarize the field activities and data analyses performed and will include data collected during the SI Field Program.

**How will the data be archived?**

Data will be stored electronically on CDs that will be archived in the project file and will be provided to EPA/USACE. Laboratory analytical results will be uploaded to the Region 2 EPA database. SI Report and HRS Documentation will be archived in the project files. Hard copies of laboratory reports will also be kept in the project file. Records and documents will be maintained for the period of 10 years.

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## QAPP Worksheet #12 – Measurement Performance Criteria Table

The data quality indicators (DQIs) for parameters for remedial investigation were assigned based on professional judgment to be used as a goal for determination of data usability. Each data set will be evaluated for any non-conformance issues and final determination of rejected data will be made by the project team. Laboratory QC criteria for methods are provided in laboratory standard operating procedures (SOPs) or the CLP Statement of Work (SOW) tables.

### Measurement Performance Criteria – Target Analyte List Metals

**Matrix: Sediment**
**Analytical Group or Method: CLP Routine ISM02.3 for TAL Metals**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | Relative percent Difference (RPD) ≤ 50% for sediment when analytes are detected in both samples ≥ 5X sample-specific Contract Required Quantitation Limit (CRQL) – Reference EPA Region 2 Data Validation SOP HW-2a/2b. |
| Analytical Precision (laboratory) | Field Duplicates<br>Laboratory Duplicate | RPD ≤ 50% – Reference EPA Region 2 Data Validation SOP HW-2a/2b.<br>RPD ≤ 20% – Reference CLP ISM02.3, Exhibit D, page D-26 (ICP-AES)/D-27 (ICP/MS). |
| Analytical Accuracy/Bias (laboratory) | Laboratory Control Samples (LCS) | LCS Recovery – Reference CLP ISM02.3, Exhibit D, page D-27 (ICP-AES)/D-28 (ICP-MS) for Criteria. |
| Analytical Accuracy/Bias (matrix interference) | Matrix Spike (MS) | MS Recovery – Reference CLP ISM02.3, Exhibit D, page D-24 (ICP-AES)/D-26 (ICP-MS) for Criteria. |
| Analytical accuracy/Bias (contamination) | Method Blanks | No target analyte concentrations >CRQL. |
| Overall accuracy/Bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL. |
| Sensitivity | Annual Method Detection Limit (MDL) Study | MDLs at or below method guidelines. |
| Completeness | See Worksheet #34 | See Worksheet #34. |

## Measurement Performance Criteria - Mercury

**Matrix: Sediment**
**Analytical Group or Method: CLP Routine ISM02.3 for Mercury**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | RPD ≤ 50% for sediment samples when analytes are detected in both samples ≥ 5X sample-specific CRQL – Reference EPA Region 2 Data Validation SOP HW-2c. |
| Analytical Precision (laboratory) | Field Duplicates<br>Laboratory Duplicate | RPD ≤ 50% – Reference EPA Region 2 Data Validation SOP HW-2c.<br>RPD ≤ 20% – Reference CLP ISM02.3, Exhibit D, page D-21 (CVAA). |
| Analytical Accuracy/Bias (matrix interference) | MS | MS Recovery – Reference CLP ISM02.3, Exhibit D, page D-20 (CVAA) for Criteria. |
| Analytical accuracy/Bias (contamination) | Method Blanks | No target analyte concentrations >CRQL. |
| Overall accuracy/Bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL. |
| Sensitivity | Annual MDL Study | MDLs at or below method guidelines. |
| Completeness | See Worksheet #34 | See Worksheet #34. |

## Measurement Performance Criteria – Target Compound List SVOCs

**Matrix: Sediment**
**Analytical Group or Method: CLP Routine SOM02.3 for TCL SVOCs**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | RPD ≤ 50% for sediment when SVOCs are detected in both samples ≥ sample-specific CRQL – Reference USEPA Region 2 Data Validation SOP HW-35. |
| Analytical Precision (laboratory) | Field Duplicates<br>MS/MSD | RPD ≤ 50% – Reference USEPA Region 2 Data Validation SOP HW-35.<br>MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 12 for Criteria. |
| Analytical Accuracy/Bias (laboratory) | Deuterated Monitoring Compounds (DMCs) | DMC - Reference CLP SOM02.3, Exhibit D, Table 11 for Criteria. |
| Analytical Accuracy/Bias (matrix interference) | Matrix Spike / Matrix Spike Duplicate (MS/MSD) | MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 12 for Criteria. |
| Analytical accuracy/Bias (contamination) | Method Blanks | No target analyte concentrations >CRQL |
| Overall accuracy/Bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL |
| Sensitivity | Annual MDL study | MDLs at or below method guidelines |
| Completeness | See Worksheet #34 | See Worksheet #34 |

## Measurement Performance Criteria - PCBs (Aroclors)

**Matrix: Sediment**
**Analytical Group or Method: CLP Routine SOM02.3 for PCBs (Aroclors)**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | RPD ≤ 50% for sediment when PCBs are detected in both samples ≥ sample-specific CRQL – Reference USEPA Region 2 Data Validation SOP HW-37. |
| Analytical Precision (laboratory) | Field Duplicates<br>MS/MSD | RPD ≤ 50% – Reference USEPA Region 2 Data Validation SOP HW-37.<br>MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 7 for Criteria. |
| Analytical Accuracy/Bias (laboratory) | Laboratory Control Samples (LCS)<br>Surrogates | LCS - Reference CLP SOM02.3, Exhibit D, Table 2 for Criteria.<br>Surrogate – Reference CLP SOM02.3, Exhibit D, Table 6 for Criteria. |
| Analytical Accuracy/Bias (matrix interference) | MS/MSD | MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 7 for Criteria. |
| Analytical accuracy/Bias (contamination) | Method Blanks | No target analyte concentrations >CRQL |
| Overall accuracy/Bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL |
| Sensitivity | Annual MDL study | MDLs at or below method guidelines |
| Completeness | See Worksheet #34 | See Worksheet #34 |

## Measurement Performance Criteria – Total Organic Carbon

**Matrix: Sediment**
**Analytical Group or Method: DESA SOP C-88 for Total Organic Carbon**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | The RPD of the duplicates should not exceed 50%. Reference SOP C-88. |
| Analytical Precision (laboratory) | Duplicate Analysis<br><br>Blank Spike/Blank Spike Duplicate (BS/BSD) | The RPD of the duplicates should not exceed 50%. If >50%, rerun the sample once for confirmation. Reference SOP C-88.<br><br>BS/BSD- The RPD should not exceed 25%. Reference SOP C-88. |
| Analytical Accuracy/Bias (laboratory) | Blank Spike | Recovery of SRM should be within 75 – 125%. Reference SOP C-88. |
| Analytical accuracy/Bias (contamination) | Initial Calibration Blank (ICB)/Continuing Calibration Blank (CCB) | If ICB/CCB result is > reporting limit then all associated samples with a concentration of ≤10X the amount in the blanks should be reanalyzed. Reference SOP C-88. |
| Sensitivity | Annual MDL study | MDLs at or below method guidelines |
| Completeness | See Worksheet #34 | See Worksheet #34 |

## Measurement Performance Criteria - Grains Size

**Matrix: Sediment**
**Analytical Group or Method: DESA SOP BIO 8.2 for Grain Size**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | The % RPD between the duplicates should be within 30%. Reference BIO-8.2 Rev 2.4. |
| Analytical Precision (laboratory) | Laboratory Duplicate and Field Duplicate | Duplicate results must not vary by more than 30%. Reference BIO-8.2 Rev 2.4. |
| Analytical Accuracy/Bias (laboratory) | Quality Control | All fractions should add up to 100 percent. |
| Sensitivity | Laboratory Duplicate and Field Duplicate | RPD does not apply when sample is predominantly sand ≥80%. Reference BIO-8.2 Rev 2.4. |
| Completeness | See Worksheet #34 | See Worksheet #34 |

## Measurement Performance Criteria - TAL Metals

**Matrix: Rinsate Water**
**Analytical Group or Method: CLP Routine ISM02.3 for TAL Metals**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | RPD ≤ 20% for rinseate water samples when analytes are detected in both samples ≥ 5X sample specific CRQL – Reference EPA Region 2 Data Validation SOP HW-2a/2b. |
| Analytical Precision (laboratory) | Field Duplicates, Laboratory Duplicates | RPD ≤ 20% – Reference EPA Region 2 Data Validation SOP HW-2a/2b/2c. RPD ≤ 20% – Reference CLP ISM02.3, Exhibit D, page D-26 (ICP-AES)/ D-27 (ICP-MS). |
| Analytical Accuracy/Bias (laboratory) | LCS | LCS Recovery– Reference CLP ISM02.3, Exhibit D, page D-27 (ICP-AES)/ D-28 (ICP-MS) for Criteria. |
| Analytical Accuracy/Bias (matrix interference) | MS/MSD | MS/MSD Recovery – Reference CLP ISM02.3, Exhibit D, page D-24 (ICP-AES)/ D-26 (ICP-MS) for criteria. |
| Analytical accuracy/bias (contamination) | Method Blanks | No target analyte concentrations >CRQL |
| Overall accuracy/bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL |
| Sensitivity | Annual MDL study | MDLs at or below method guidelines |
| Completeness | See Worksheet #34 | See Worksheet #34 |

## Measurement Performance Criteria - Mercury

**Matrix: Rinsate Water**
**Analytical Group or Method: CLP Routine ISM02.3 for Mercury**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | RPD ≤ 20% for rinsate water samples when analytes are detected in both samples ≥ 5X sample specific CRQL – Reference EPA Region 2 Data Validation SOP HW-2c. |
| Analytical Precision (laboratory) | Field Duplicates<br>Laboratory Duplicate | RPD ≤ 20% – Reference EPA Region 2 Data Validation SOP HW-2c.<br>RPD ≤ 20% – Reference CLP ISM02.3, Exhibit D, page D-21 (CVAA). |
| Analytical Accuracy/Bias (matrix interference) | MS | MS Recovery – Reference CLP ISM02.3, Exhibit D, page D-20 (CVAA). |
| Analytical accuracy/Bias (contamination) | Method Blanks | No target analyte concentrations >CRQL |
| Overall accuracy/Bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL. |
| Sensitivity | Annual MDL study | MDLs at or below method guidelines. |
| Completeness | See Worksheet #34 | See Worksheet #34. |

## Measurement Performance Criteria – TCL SVOCs

**Matrix: Rinsate Water**
**Analytical Group or Method: CLP Routine SOM02.3 TCL SVOCs**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | RPD ≤ 50% for rinsate water when VOCs are detected in both samples ≥ sample-specific CRQL – Reference USEPA Region 2 Data Validation SOP HW-35. |
| Analytical Precision (laboratory) | Field Duplicates<br>MS/MSD | RPD ≤ 50% – Reference USEPA Region 2 Data Validation SOP HW-35.<br>MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 12 for Criteria |
| Analytical Accuracy/Bias (laboratory) | Deuterated Monitoring Compounds (DMC) | DMC - Reference CLP SOM02.3, Exhibit D, Table 11 for Criteria |
| Analytical Accuracy/Bias (matrix interference) | MS/MSD, | MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 12 for Criteria |
| Analytical accuracy/Bias (contamination) | Method Blanks | No target analyte concentrations >CRQL |
| Overall accuracy/Bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL |
| Sensitivity | Annual MDL study | MDLs at or below method guidelines |
| Completeness | See Worksheet #34 | See Worksheet #34 |

## Measurement Performance Criteria – PCBs (Aroclors)

**Matrix: Rinsate Water**
**Analytical Group or Method: CLP Routine SOM02.3 PCBs (Aroclors)**
**Concentration Level: Low**

| Data Quality Indicator (DQI) | QC sample or measurement performance activity | Measurement Performance Criteria |
|---|---|---|
| Overall Precision | Field Duplicates | RPD ≤ 50% for rinsate water when PCBs are detected in both samples ≥ sample-specific CRQL – Reference EPA Region 2 Data Validation SOP HW-37. |
| Analytical Precision (laboratory) | Field Duplicates<br>MS/MSD | RPD ≤ 50% – Reference EPA Region 2 Data Validation SOP HW-37.<br>MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 7 for Criteria. |
| Analytical Accuracy/Bias (laboratory) | Laboratory Control Samples (LCS)<br>Surrogates | LCS – Reference CLP SOM02.3, Exhibit D, Table 2 for Criteria.<br>Surrogate – Reference CLP SOM02.3, Exhibit D, Table 6 for Criteria. |
| Analytical Accuracy/Bias (matrix interference) | MS/MSD | MS/MSD – Reference CLP SOM02.3, Exhibit D, Table 7 for Criteria. |
| Analytical accuracy/Bias (contamination) | Method Blanks | No target analyte concentrations >CRQL. |
| Overall accuracy/Bias (contamination) | Equipment Blanks | No target analyte concentrations >CRQL. |
| Sensitivity | Annual MDL Study | MDLs at or below method guidelines. |
| Completeness | See Worksheet #34 | See Worksheet #34 |

## QAPP Worksheet #13 – Secondary Data Uses and Limitations

This table identifies sources of secondary data and is included as applicable for the Hackensack River.

**Secondary Data Criteria and Limitations**

| Data Type | Source (originating organization, report title and date) | Data Uses Relative to Current Project (originating organization, data types, data generation / collection dates) | Factors Affecting the Reliability of Data and Limitations on Data Use |
|---|---|---|---|
| Historical Data | NOAA Environmental Data Repository | See NOAA Environmental Data Repository | Data may be used to fill SI / HRS data gaps. |

## QAPP Worksheet #14 & 16 – Project Tasks and Schedule

The project activities that will be performed during the course of the project are listed below. A master schedule will be maintained by the CTI Team and updated in monthly progress reports. The major tasks related to the QAPP are summarized below.

### Project Tasks and Schedule

| Activity | Responsible Party | Planned Start Date | Planned Completion Date | Deliverable(s) | Deliverable Due Date |
|---|---|---|---|---|---|
| Work Plan | CTI Team | 3/14/2016 | 5/31/2016 | Final Work Plan | 5/31/16 |
| QAPP | CTI Team | 3/14/2016 | 6/16/2016 | Final QAPP | 6/16/16 |
| ASR to EPA/DESA | CTI Team | 5/3/2016 | 5/30/2016 | ASR submitted to EPA | 5/30/16 |
| Sediment Sampling | CTI Team | 6/20/2016 | 8/12/2016 | Field Logbooks and Daily Reports, Scribe Data | Daily |
| Routine Sample Analysis | DESA/CLP Laboratory | 6/20/2016 | 9/2/2016 | Data Package in PDF format | 21 days from sample receipt |
| Sample Analysis Validation | EPA | | 9/23/2016 | Data Validation Report | 21 days from data delivery |
| Data Evaluation | CTI Team | 6/20/2016 | 11/8/2016 | | |
| Electronic Data Submission | CTI Team | 9/23/2016 | 10/23/2016 | Validated Region 2 EPA EDD submitted to Region 2 EPA database | 10/23/2016 |
| Site Inspection Report | CTI Team | 6/20/2016 | 3/7/2017 | SI Report to EPA/USACE | 3/7/2017 |
| HRS Documentation | CTI Team | 6/20/2016 | 3/7/2017 | HRS Documentation to EPA/USACE | 3/7/2017 |

## QAPP Worksheet #15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

The following worksheet identifies the target analytes/contaminants of concern (COC). The quantitation limits (QLs) that must be met to achieve the project quality objectives and quantitation limits from reference methods also are listed.

**Reference Limits – TAL Metals**

Matrix: Sediment
Analytical Method: CLP Routine ISM02.3 for TAL Metals
Concentration Level: Low

| Analyte | CAS No. | Project Action Limit (PAL) (mg/kg)[1] | Project Quantitation Limit Goal (mg/kg)[2] | Analytical Method-SOM02.3 CRQL (mg/kg) |
|---|---|---|---|---|
| Aluminum | 7429-90-5 | 25,500 | 20 | 20 |
| Antimony | 7440-36-0 | NA | 1 | 1 |
| Arsenic | 7440-38-2 | 6 | 0.5 | 0.5 |
| Barium | 7440-39-3 | NA | 5 | 5 |
| Beryllium | 7440-41-7 | NA | 0.5 | 0.5 |
| Cadmium | 7440-43-9 | 0.6 | 0.5 | 0.5 |
| Calcium | 7440-70-2 | NA | 500 | 500 |
| Chromium | 7440-47-3 | 26 | 1 | 1 |
| Cobalt | 7440-48-4 | 50 | 0.5 | 0.5 |
| Copper | 7440-50-8 | 16 | 1 | 1 |
| Iron | 7439-89-6 | NA | 10 | 10 |
| Lead | 7439-92-1 | 31 | 0.5 | 0.5 |
| Magnesium | 7439-95-4 | NA | 500 | 500 |
| Manganese | 7439-96-5 | 630 | 0.5 | 0.5 |
| Nickel | 7440-02-0 | 16 | 0.5 | 0.5 |
| Potassium | 7440-09-7 | NA | 500 | 500 |
| Selenium | 7782-49-2 | NA | 2.5 | 2.5 |
| Silver | 7440-22-4 | 0.5 | 0.5 | 0.5 |
| Sodium | 7440-23-5 | NA | 500 | 500 |
| Thallium | 7440-28-0 | NA | 0.5 | 0.5 |
| Vanadium | 7440-62-2 | NA | 2.5 | 2.5 |
| Zinc | 7440-66-6 | 120 | 1 | 1 |
| Mercury | 7439-97-6 | 0.174 | 0.1 | 0.1 |

1. PAL Reference is Sediment (Fresh Water Criteria, Lowest Effects Level) Ecological Screening Criteria: United States Environmental Protection Agency Region 2, (03/10/2009), http://www.nj.gov/dep/srp/guidance/ecoscreening/
2. Project QL goals are the ISM02.3 CRQLs.

Key:
NA = Not Available, Highlighted rows are contaminants of concern.

## Reference Limits CLP Routine - Organic SOM02.3 SVOCs

Matrix: Sediment
Analytical Method: CLP Routine SOM02.3 SVOCs
Concentration Level: Low

| Analyte | CAS No. | Project Action Limit (PAL) (mg/kg)[1,2] | Project Quantitation Limit Goal (mg/kg)[3] | Analytical Method-SOM02.3 CRQL (mg/kg) |
|---|---|---|---|---|
| 1,4-Dioxane | 123-91-1 | NA | 0.067 | 0.067 |
| Benzaldehyde | 100-52-7 | NA | 0.33 | 0.33 |
| Phenol | 108-95-2 | **0.0491** | 0.33 | 0.33 |
| Bis(2-chloroethyl) ether | 111-44-4 | 3.520 | 0.33 | 0.33 |
| 2-Chlorophenol | 95-57-8 | **0.0319** | 0.17 | 0.17 |
| 2-Methylphenol | 95-48-7 | NA | 0.33 | 0.33 |
| 2,2'-Oxybis(1-choloropropane) | 108-60-1 | NA | 0.33 | 0.33 |
| Acetophenone | 98-86-2 | NA | 0.33 | 0.33 |
| 4-Methylphenol | 106-44-5 | NA | 0.33 | 0.33 |
| N-Nitroso-di-n propylamine | 621-64-7 | NA | 0.17 | 0.17 |
| Hexachloroethane | 67-72-1 | 0.584 | 0.17 | 0.17 |
| Nitrobenzene | 98-95-3 | **0.145** | 0.17 | 0.17 |
| Isophorone | 78-59-1 | 0.432 | 0.17 | 0.17 |
| 2-Nitrophenol | 88-75-5 | NA | 0.17 | 0.17 |
| 2,4-Dimethylphenol | 105-67-9 | 0.304 | 0.17 | 0.17 |
| Bis(2-chloroethoxy) methane | 111-91-1 | NA | 0.17 | 0.17 |
| 2,4-Dichlorophenol | 120-83-2 | **0.0817** | 0.17 | 0.17 |
| Naphthalene | 91-20-3 | 0.176 | 0.17 | 0.17 |
| 4-Chloroaniline | 106-47-8 | NA | 0.33 | 0.33 |
| Hexachlorobutadiene | 87-68-3 | **0.0265** | 0.17 | 0.17 |
| Caprolactam | 105-60-2 | NA | 0.33 | 0.33 |
| 4-Chloro-3-methylphenol | 59-50-7 | NA | 0.17 | 0.17 |
| 2-Methylnaphthalene | 91-57-6 | **0.0202** | 0.17 | 0.17 |
| Hexachlorocyclopentadiene | 77-47-4 | 0.901 | 0.33 | 0.33 |
| 2,4,6-Trichlorophenol | 88-06-2 | 0.208 | 0.17 | 0.17 |
| 2,4,5-Trichlorophenol | 95-95-4 | NA | 0.17 | 0.17 |
| 1,1-Biphenyl | 92-52-4 | NA | 0.17 | 0.17 |
| 2-Chloronaphthalene | 91-58-7 | 0.417 | 0.17 | 0.17 |
| 2-Nitroaniline | 88-74-4 | NA | 0.17 | 0.17 |
| Dimethylphthalate | 131-11-3 | NA | 0.17 | 0.17 |
| 2,6-Dinitrotoluene | 606-20-2 | NA | 0.17 | 0.17 |
| Acenaphthylene | 208-96-8 | **0.00587** | 0.17 | 0.17 |
| 3-Nitroaniline | 99-09-2 | NA | 0.33 | 0.33 |
| Acenaphthene | 83-32-9 | **0.00671** | 0.17 | 0.17 |

## Reference Limits CLP Routine - Organic SOM02.3 SVOCs

Matrix: Sediment
Analytical Method: CLP Routine SOM02.3 SVOCs
Concentration Level: Low

| Analyte | CAS No. | Project Action Limit (PAL) (mg/kg)[1,2] | Project Quantitation Limit Goal (mg/kg)[3] | Analytical Method-SOM02.3 CRQL (mg/kg) |
|---|---|---|---|---|
| 2,4-Dinitrophenol | 51-28-5 | **0.00621** | 0.33 | 0.33 |
| 4-Nitrophenol | 100-02-7 | **0.0133** | 0.33 | 0.33 |
| Dibenzofuran | 132-64-9 | NA | 0.17 | 0.17 |
| 2,4-Dinitrotoluene | 121-14-2 | **0.0144** | 0.17 | 0.17 |
| Diethylphthalate | 84-66-2 | 0.295 | 0.17 | 0.17 |
| Fluorene | 86-73-7 | **0.0774** | 0.17 | 0.17 |
| 4-Chlorophenyl-phenyl ether | 7005-72-3 | NA | 0.17 | 0.17 |
| 4-Nitroaniline | 100-01-6 | NA | 0.33 | 0.33 |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | NA | 0.33 | 0.33 |
| N-Nitrosodiphenylamine | 86-30-6 | NA | 0.17 | 0.17 |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | NA | 0.17 | 0.17 |
| 4-Bromophenyl-phenylether | 101-55-3 | NA | 0.17 | 0.17 |
| Hexachlorobenzene | 118-74-1 | **0.020** | 0.17 | 0.17 |
| Atrazine | 1912-24-9 | NA | 0.33 | 0.33 |
| Pentachlorophenol | 87-86-5 | 23 | 0.33 | 0.33 |
| Phenanthrene | 85-01-8 | 0.204 | 0.17 | 0.17 |
| Anthracene | 120-12-7 | **0.0572** | 0.17 | 0.17 |
| Carbazole | 86-74-8 | NA | 0.33 | 0.33 |
| Di-n-butylphthalate | 84-74-2 | 1.114 | 0.17 | 0.17 |
| Fluoranthene | 206-44-0 | 0.423 | 0.33 | 0.33 |
| Pyrene | 129-00-0 | 0.195 | 0.17 | 0.17 |
| Butylbenzylphthalate | 85-68-7 | 1.970 | 0.17 | 0.17 |
| 3,3'-dicholorobenzidine | 91-94-1 | 0.127 | 0.33 | 0.33 |
| Benzo(a)anthracene | 56-55-3 | **0.108** | 0.17 | 0.17 |
| Chrysene | 218-01-9 | **0.166** | 0.17 | 0.17 |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | 0.182 | 0.17 | 0.17 |
| Di-n-octylphthalate | 117-84-0 | NA | 0.33 | 0.33 |
| Benzo(b) fluoranthene | 205-99-2 | 10.4 | 0.17 | 0.17 |
| Benzo(k) fluoranthene | 207-08-9 | 0.240 | 0.17 | 0.17 |
| Benzo(a) pyrene | 50-32-8 | NA | 0.17 | 0.17 |
| Indeno(1,2,3,-cd) pyrene | 193-39-5 | 0.200 | 0.17 | 0.17 |
| Dibenzo(a,h) anthracene | 53-70-3 | **0.033** | 0.17 | 0.17 |
| Benzo(g,h,i) perylene | 191-24-2 | 0.170 | 0.17 | 0.17 |
| 2,3,4,6-Tetrachlorophenol | 58-90-2 | NA | 0.17 | 0.17 |

**Reference Limits CLP Routine - Organic SOM02.3 SVOCs**

Matrix: Sediment
Analytical Method: CLP Routine SOM02.3 SVOCs
Concentration Level: Low

| Analyte | CAS No. | Project Action Limit (PAL) (mg/kg)[1,2] | Project Quantitation Limit Goal (mg/kg)[3] | Analytical Method-SOM02.3 CRQL (mg/kg) |
|---|---|---|---|---|

1 Applicable or Relevant and Appropriate Requirements (ARARs) will be evaluated as part of the Feasibility Study. In several instances, the CRQL is greater than the PAL. Positive detections will be used for decision making.
2 PAL Reference is Sediment (Fresh Water Criteria, Lowest Effects Level) Ecological Screening Criteria: United States Environmental Protection Agency Region 2, (03/10/2009), http://www.nj.gov/dep/srp/guidance/ecoscreening/
3 Project QL goals are the SOM02.3 CRQLs.

Key:
NA = Not Available
Bold PAL values indicate that the PAL is less than the CRQL.
Highlighted rows are contaminants of concern.

**Reference Limits – PCBs (Aroclors)**

Matrix: Sediment
Analytical Method: CLP Routine SOM02.3 for PCBs
Concentration Level: Low

| Analyte | CAS No. | Project Action Limit (PAL) (mg/kg)[1] | Project Quantitation Limit Goal (mg/kg)[3] | Analytical Method SOM02.3 CRQL (mg/kg) |
|---|---|---|---|---|
| Aroclor-1016 | 12674-11-2 | **0.007** | 0.033 | 0.033 |
| Aroclor-1221 | 11104-28-2 | NA | 0.033 | 0.033 |
| Aroclor-1232 | 11141-16-5 | NA | 0.033 | 0.033 |
| Aroclor-1242 | 53469-21-9 | NA | 0.033 | 0.033 |
| Aroclor-1248 | 12672-29-6 | **0.030** | 0.033 | 0.033 |
| Aroclor-1254 | 11097-69-1 | 0.060 | 0.033 | 0.033 |
| Aroclor-1260 | 11096-82-5 | **0.005** | 0.033 | 0.033 |
| Aroclor-1262 | 37324-23-5 | NA | 0.033 | 0.033 |
| Aroclor-1268 | 11100-14-4 | NA | 0.033 | 0.033 |

1. ARARs will be evaluated as part of the Feasibility Study. In several instances, the CRQL is greater than the PAL. Positive detections will be used for decision making.
2. PAL Reference is Sediment (Fresh Water Criteria, Lowest Effects Level) Ecological Screening Criteria: United States Environmental Protection Agency Region 2, (03/10/2009), http://www.nj.gov/dep/srp/guidance/ecoscreening/
3. Project QL goals are the SOM02.3 CRQLs.

Key:
NA = Not Available
Bold PAL values indicate that the PAL is less than the CRQL.
Highlighted rows are contaminants of concern.

## QAPP Worksheet #17 – Sampling Design and Rationale

The objective of the LHR SI is to provide the chemical and physical data required to complete the SI report and HRS documentation record to determine if additional investigation under CERCLA may be warranted at the site. To meet these objectives, a review of available NOAA environmental data repository laboratory analytical data was conducted to identify potential data gaps. Based on this review, it was determined characterization of the LHR surface and subsurface sediment contamination and documentation of background concentrations of hazardous substances in sediment through a scientifically sound comprehensive investigation was necessary to complete the SI report and HRS documentation record. The proposed LHR SI will provide data that will be used to map where contamination is located and where potential sources and releases may exist along the river. The current NOAA environmental data suggests there are contaminated sediments along the river and that flood and ebb tidal influences over the industrial history of the LHR may be creating conditions conducive to sediment mixing.

The background samples have been selected to account for variability in local concentrations and matrix which provides the concentration of a hazardous substance that is a defensible reference point used to evaluate whether or not a release has occurred and the concentration of the hazardous substance in the medium of concern for the different environmental settings within the LHR. Determining background level is necessary to establish an observed release (or observed contamination) by chemical analysis. The background samples will represent the upstream river conditions near Oradell Dam in the residential/commercial section of the LHR, the industrialized section of the LHR in the vicinity of Overpeck Creek, and the mouth of the LHR where flood tidal influences may impact the sediment quality of LHR due to upstream migration of potential contaminants during flood tide. Similarity between release samples and proposed background sampling locations included sample collection procedures and depths, analytical methods and laboratories, sample time frame, physical setting, salinity associated with the estuarine river environment, and sediment depositional environment. The objective is to collect background samples as similar as possible to the release samples used to establish an observed release by chemical analysis, sediment grainsize distribution, and total organic carbon (TOC).

The sampling strategy is supported by the information in the LHR PA and NOAA environmental analytical data. This existing NOAA data was used to identify sampling locations and will be used to provide quantitative evidence of historic contamination in the LHR.

The methods and procedures for sample collection and handling to address the above objectives are described herein, and will be pursued according to the 40 CFR Part 300, Hazard Ranking System, Final Rule. Sample stations for the SI Field Program are provided in Figures 3-1 thru 3-4. A detailed breakdown of the LHR sample stations by river mile is presented in Attachment A of the FSP. SI field activities will be conducted in accordance with this UFP-QAPP/FSP and HASP (CTI 2016).

The SI field work is designed to broadly characterize the physical properties and chemical nature of the sediments along the length of the LHR. The Hackensack River SI sampling approach includes co-located surface sediment and subsurface sediment samples collected in the fine grained depositional sections of the river (point bars, subtidal and tidal flats, etc.) from the river's mouth to the Oradell Dam. Sediment sample locations were selected based on review of historical aerial photography depicting low tide sediment deposits and the 2007 multibeam bathymetric survey, side scan sonar imaging, sub bottom profiles, and sediment core data provided in the *Final Report Geophysical Investigation as part of the Design of the Hackensack River Enhancement Project, (USACE-NYD, July 2008)*. Evaluation of this data and specifically the bathymetric survey and sediment characterization data provided insight into viable sample location from the mouth of the Hackensack River (RM 0.0) to the Overpeck Creek tributary at river mile 13.5.

Upstream of Overpeck Creek, depositional sections of the LHR were identified through low tide aerial photography interpretation, review of NOAA navigation charts (Passaic and Hackensack River, United States – East Coast, New Jersey, Chart No. 12337), and evaluation of river geomorphology. By focusing sample collection strategy in the fine grained sediment

depositional sections of the river, surface and subsurface samples representative of recent and historical sediment contamination with similar grainsize and total organic carbon should be collected.

The 2008 Geophysical Investigation Report also summarized the dredging history of the Hackensack River. A shipping channel has been dredged from the mouth of the Hackensack River to the turning basin at river mile 3.75. Based on the Geophysical Survey Report, river maintenance dredging has been historically performed along various river sections over time, up to approximately river mile 14.5. The NOAA navigation charts indicated a maintained river channel up to approximately river mile 17.1. In consideration of the dredging history, proposed sediments sample stations have been located outside the shipping channel.

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## QAPP Worksheet #18 – Sampling Locations and Methods

See the FSP (Appendix A) for sampling location and methods requirements information.

| Sample Summary | | Number of Samples | | | | | | Number of Samples per Method | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample Media** | **Notes** | **No. of Locations** | **No. of Background Locations** | **No. of Samples** | **No. of MS and MSD Samples** | **No. of FD Samples** | **Total Samples** | **TAL Metals** | **TCL SVOCs** | **PCBs** | **TOC** | **Grain Size** |
| Sediment | 184 Locations with one surface and one subsurface sample per location<br><br>6 Locations with one surface sample only | 190 (Includes 8 background locations) | 8 | 374 | 19 (Collected at a rate of 5% or 1 per 20 samples) | 19 (Collected at a rate of 5% or 1 per 20 samples) | 412 | 412 | 412 | 412 | 412 | 119 (30% of total samples) |
| **Totals** | | 190 | 8 | 374 | 19 | 19 | 412 | 412 | 412 | 412 | 412 | 119 |

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## QAPP Worksheet #19 & 30 – Sample Containers, Preservation, and Hold Times

Laboratory: DES CLP Laboratory
Back-up Laboratory: N/A
Sample Delivery Method: Shipping Overnight

### Sample Containers, Preservation, and Hold Times

| Matrix | Analytical Group | Analytical / Preparation Method SOP Reference[1] | Containers (number, size, and type) | Sample volume[3] (units) | Preservation Requirements | Analytical Holding Time[2] (preparation / analysis) | Data Package Turnaround Time[4] |
|---|---|---|---|---|---|---|---|
| Sediment | TAL Metals | CLP ISM02.3 | (1) 8 oz. glass jar w/Teflon lined cap | Fill to Capacity | Cool to 4°C | 180 days (except Hg 28 days) | 42 days |
| Sediment | SVOCs | CLP SOM02.3 | (1) 8 oz. glass jar w/Teflon lined cap | 150 grams | Cool to 4°C | 14 days / 40 days | 42 days |
| Sediment | PCBs | CLP SOM02.3 | (1) 8 oz. glass jar w/Teflon lined cap | 150 grams | Cool to 4°C | 14 days / 40 days | 42 days |
| Sediment | TOC | DESA SOP C-88 | (1) 8 oz. glass jar with Teflon lined cap | 100 grams | Cool to 4°C | None | 42 days |
| Sediment | Grain Size | DESA SOP BIO 8.2 | (2) 8 oz. glass jar with Teflon lined cap | 250 grams | Cool to 4°C | None | 42 days |
| Water (Rinsate) | TCL Metals | CLP ISM02.3 | 1 L HDPE bottle | 1 L | Cool to 4°C, $HNO_3$<2 pH | 180 days for metals except Hg, 28 days | 42 days |
| Water (Rinsate) | SVOCs | CLP SOM02.3 | (2) 1 L amber round glass bottle w/Teflon-lined cap | 2 L | Cool to 4°C | 7 days / 40 days | 42 days |
| Water (Rinsate) | PCBs | CLP SOM02.3 | (2) 1 L amber round glass bottle w/Teflon-lined cap | 2 L | Cool to 4°C | 7 days / 40 days | 42 days |

[1] Refer to the Analytical SOP References table (Worksheet #23).
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
[3] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory MS/MSD sample analysis.
[4] 21 day turnaround time for laboratory results plus 21-day turnaround time for data validation.

# QAPP Worksheet #20 – Field Quality Control Summary

**Field Quality Control Summary**

| Sample Matrix | Analyte/ Analytical Group | Conc Level | Analytical and Preparation SOP Reference | No. of Sampling Locations | No. of Field Samples | No. of Field Duplicate Sample Pairs | No. of MS/MSDs | No. of Field Blanks | No. of Equipment Rinsate Blanks | No. of Trip Blanks | Total Number of Analyses |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sediment | TAL Metals | Low | CLP ISM02.3 | 190 | 374 | 1 per 20 samples (19 field duplicates) | 1 per 20 samples (19 MS/DUPs) | 0 | 1 per 20 samples (19 rinsates) | 0 | 431 |
| Sediment | TCL SVOCs | Low | CLP SOM02.3 | 190 | 374 | 1 per 20 samples (19 field duplicates) | 1 per 20 samples (19 MS/MSDs) | 0 | 1 per 20 samples (19 rinsates) | 0 | 431 |
| Sediment | PCBs | Low | CLP SOM02.3 | 190 | 374 | 1 per 20 samples (19 field duplicates) | 1 per 20 samples (19 MS/MSDs) | 0 | 1 per 20 samples (19 rinsates) | 0 | 431 |
| Sediment | TOC | Low | DESA SOP C-88 | 190 | 374 | 1 per 20 samples (19 field duplicates) | 1 per 20 samples (19 MS/MSDs) | 0 | 0 | 0 | 431 |
| Sediment | Grain Size | Low | Grain Size DESA SOP (hydrometer) BIO 8.2, | 113 | 113 | 1 per 20 samples (6 field duplicates) | 0 | 0 | 0 | 0 | 119 |

## QAPP Worksheet #21 – Field SOPs

CTI will follow procedures presented in the FSP (QAPP Appendix A).
Specific field SOPs have not been developed for this project.

## QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection

The field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection are summarized below.

### Field Equipment Calibration, Maintenance, Testing, and Inspection

| Instrument or Equipment[a] | Activity | SOP Reference | Frequency | Acceptability/ Performance Criteria | Corrective Action | Responsible Personnel |
|---|---|---|---|---|---|---|
| Global Positioning Satellite (GPS) Navigation | Sample Station Navigation | Per the manufacturer's guidelines. | Per the manufacturer's guidelines. | Meter must give consistent location readings with respect to sample station coordinates presented in FSP. | Recalibrate per manufacturers guidelines. | Field Team Leader, Project Geologist |
| Water Depth Finder – Sample Vessel Mounted | Bathymetric Surveying | Per the manufacturer's guidelines | Per the manufacturer's guidelines. | Comparison to weighted tape direct measurement | Replace unit | Field Team Leader, Project Geologist |

[a] Description is for typical equipment; equivalent units may be used.

## QAPP Worksheet #23 – Analytical SOPs References Table

**Analytical SOPs – DESA/CLP Laboratory**

| SOP # | Title, Date, and URL (if available) | Definitive or Screening Data | Matrix/Analytical Group | SOP Option or Equipment Type | ‡Modified for Project? Y/N |
|---|---|---|---|---|---|
| CLP ISM02.3 | EPA Contract Laboratory Program Statement of Work for Multi-Media, Multi-Concentration Organic Analysis, September 2015 | Definitive | Target Analyte List for Metals | ICP-AES and ICP/MS | N |
| CLP SOM02.3 | EPA Contract Laboratory Program Statement of Work for Multi-Media, Multi-Concentration Organic Analysis, September 2015 | Definitive | Target Compound List for Semi-volatile | GC/MS | N |
| CLP SOM02.3 | EPA Contract Laboratory Program Statement of Work for Multi-Media, Multi-Concentration Organic Analysis, September 2015 | Definitive | Target Compound List for PCBs | GC/ECD | N |
| DESA BIO 8.2 | EPA Standard Operating Procedure Sediment Grainsize Analysis Bucket Method, October 31, 2014, Revision 2.4, | Definitive | Grain Size | Bucket Method | N |
| DESA C-88 | EPA Standard Operating Procedure, Total Organic Carbon – Sediments, October 31, 2014, Revision 2.6, SOP C-88 | Definitive | Total Organic Carbon | Shimadzu TOC-L analyzer with solids module. | N |

## QAPP Worksheet #24 – Analytical Instrument Calibration

### Analytical Instrument Calibration – DESA/CLP Laboratory

| Instrument | Calibration Procedure | Calibration Range | Frequency of Calibration | Acceptance Criteria | Corrective Action (CA) | Person Responsible for CA | SOP Reference[1] |
|---|---|---|---|---|---|---|---|
| GC/MS | See SOM02.3 | Low | Initial calibration: upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met.<br>Continuing calibration: Once every 12 hours | Initial calibration/ Continuing calibration: relative response factor (RRF) greater than or equal to minimum acceptable response factor listed in Table 5 of procedure; %RSD must be less than or equal to value listed in Table 5 of procedure. | Initial calibration: inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate.<br>Continuing calibration: inspect system, recalibrate the instrument, reanalyze samples. | EPA CLP RAS Laboratory GC/MS Technician | SOM02.3 |
| **GC/ECD** | See SOM02.3 | Low | Initial calibration: upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met.<br>Calibration verification: Once every 12 hours | Initial calibration/ Calibration verification: resolution between two adjacent peaks must be greater than or equal to 60.0 percent, single components must be greater than or equal to 90.0 percent resolved, RTs within the RT window, %D must be greater than or equal to -25 percent and less than or equal to 25 percent, %RSD must be less than or equal to 20.0 percent. | Initial calibration: inspect the system (e.g., change the column, bake out the detector, clean the injection port), correct problem, re-calibrate.<br>Calibration verification: inspect system, recalibrate the instrument, reanalyze samples. | EPA CLP RAS Laboratory GC/ECD Technician | SOM02.3 |

## Analytical Instrument Calibration – DESA/CLP Laboratory

| Instrument | Calibration Procedure | Calibration Range | Frequency of Calibration | Acceptance Criteria | Corrective Action (CA) | Person Responsible for CA | SOP Reference[1] |
|---|---|---|---|---|---|---|---|
| ICP-AES / ICP-MS | See ISM02.3 ; as per instrument manufacturer's recommended procedures | Low. | ICP-AES or ICP-MS Initial calibration: daily or once every 24 hours and each time the instrument is set up.<br>ICP-AES or ICP-MS Continuing calibration: beginning and end of run, and frequency of 10% or every 2 hours during an analysis run. | ICP-AES: As per instrument manufacturer's recommended procedures, with at least 2 standards.<br>ICP-MS: As per instrument manufacturer's recommended procedures, with at least 2 standards. A minimum of three replicate integrations are required for data acquisition. | ICP-AES or ICP-MS: inspect the system, correct problem, re-calibrate, reanalyze samples. | EPA CLP RAS Laboratory ICP-AES / ICP-MS Technician | ISM02.3 |
| TOC-L analyzer | See C-88 | Low | | Correlation coefficient must be >0.995 with a minimum of 5 standards | Correct the problem and repeat the calibration. | DESA Laboratory Technician | C-88 |

1- This is a summary of the acceptance criteria; refer to the method SOP for specific or more information.

## QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection

### Analytical Instrument and Equipment Maintenance – DESA/CLP Laboratory

| Instrument/ Equipment | Maintenance Activity | Testing/Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference[1] |
|---|---|---|---|---|---|---|---|
| GC/MS | See SOM02.3; as per instrument manufacturer's recommendations | See SOM02.3; as per instrument manufacturer's recommendations | See SOM02.3; as per instrument manufacturer's recommendations | Acceptable re-calibration; see SOM02.3 | Inspect the system, correct problem, re-calibrate and/or reanalyze samples. | EPA CLP RAS Laboratory GC/MS Technician | SOM02.3 |
| GC/ECD | See SOM02.3; as per instrument manufacturer's recommendations | See SOM02.3; as per instrument manufacturer's recommendations | See SOM02.3; as per instrument manufacturer's recommendations | Acceptable re-calibration; see SOM02.3 | Inspect the system, correct problem, re-calibrate and/or reanalyze samples. | EPA CLP RAS Laboratory GC/ECD Technician | SOM02.3 |
| ICP-AES / ICP-MS | As per instrument manufacturer's recommendations | As per instrument manufacturer's recommendations; check connections | As per instrument manufacturer's recommendations | Acceptable re-calibration; see ISM02.3 | Inspect the system, correct problem, re-calibrate and/or reanalyze samples. | EPA CLP RAS Laboratory ICP-AES / ICP-MS Technician | ISM02.3 |
| TOC-L analyzer | As per instrument manufacturer's recommendations | As per instrument manufacturer's recommendations; check connections | As per instrument manufacturer's recommendations | Acceptable re-calibration; see C-88 | Inspect the system, correct problem, re-calibrate and/or reanalyze samples. | DESA Laboratory Technician | C-88 |

## QAPP Worksheet #26 & 27 – Sample Handling, Custody, and Disposal

This section identifies components of the project-specific sample handling system used by the CTI team and the laboratories. All field samples will be disposed by the laboratory according to their internal procedures. Samples must be stored at the laboratory for a minimum of 30 days after the final report is submitted.

Sampling Organizations: CTI Team
Laboratories: DESA/CLP Laboratory
Method of sample delivery: Overnight shipping
Number of days from reporting until sample disposal: 30

**Sample Handling, Custody, and Disposal**

| Activity | Organization/Title of Responsible Person | FSP Reference |
|---|---|---|
| Sample Labeling | CTI/field sample coordinator | Section 4.8.2 |
| Chain-of-Custody | CTI/field sample coordinator | Section 4.8.3 |
| Sample Packaging | CTI/field sample coordinator | Section 4.7.2 |
| Shipping Coordination | CTI/field sample coordinator | Section 4.7.3 |
| Sample Custody and Storage | CTI/field sample coordinator | Section 4.7.3 and Section 4.8.3 |

Unique sample identification numbers have been established for each sample station. The nomenclature that will be used is {matrix code} {station identification number} - {modifier} where:

A 2-character matrix code will be used to indicate the sample matrix. Matrix codes are as follows:

SS = Surface Sediment Sample

VC = Subsurface Sediment Core Sample collected by vibra-core

PS = Subsurface Sediment Core Sample collected by piston sampler

Station identification = 7-character identifier for each station identified in **Figures 3-1 thru 3-4**. The station identifier will begin with a 3-character identifier "LHR" to identify the station as located on the Lower Hackensack River, followed by 3-digit station number that indicates the sequential numbering of sample stations from the mouth of the LHR at river mile 0.0 to 22.0. There are a total of 190 sample stations along the LHR.

Sample designation modifiers include the following:

- Field duplicates will be identified by adding 01 after the Station identifier.
- Matrix spike / matrix spike duplicates will be identified by MS/MSD after the matrix code.

- RB = Rinsate Blank (Require a station identifier/matrix code to correlate to original sample.)
- Background sample stations will be identified by adding BG after the matrix code. Background sample stations are designated as distinct sample stations by a separate 3-digit station number that indicates the sequential numbering of background sample stations. There are a total of eight background sample stations. (four adjacent to the New Millford Water Treatment Plant near the Oradell Dam, and four at Overpeck Creek, and four co-located background/LHR characterization sample station located at river mile 0.0 to 0.5)

Sample designation examples:

- A surface grab sample collected at the 26th station of the LHR would have the sample designation: SSLHR026
- The duplicate of this sample would have the sample designation: SSLHR02601
- A subsurface sediment core sample collected by vibra-core co-located at the 26th station of the LHR would have the sample designation: VCLHR026
- A rinsate blank collected in association with subsurface sediment core sample collected by vibra-core at the 26th station of the LHR would have the sample designation: SSLHR026RB

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): CLP laboratory assignments and DESA sample ID numbers will be assigned by DESA prior to field sampling. Each sample will be individually identified and labeled after collection, and placed into a plastic cooler with ice. The sample collection information will be recorded in the SCRIBE program and a standardized chain-of-custody (COC) form will be produced from the program. The samples will be shipped to the laboratory via overnight delivery service within one day of sample collection. Refer to the U.S. EPA OSWER 9200.2-147, EPA 540-R-014-013 Contract Laboratory Program Guidance for Field Samplers, dated October 2014. An EPA Trip Report will be prepared on a weekly basis for samples collected during each one week period.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): A sample custodian at the laboratory will accept custody of the shipped samples and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. At this time, no samples will be archived at the laboratory. Disposal of the samples will occur only after analyses and QA/QC checks are completed

## QAPP Worksheet #28 – Analytical Quality Control and Corrective Action

The QC sample criteria that will be used is specified in QAPP Worksheet #12 or the laboratory SOPs. QAPP Worksheet #20 - Field Quality Control Summary provides an overview of the field QC sample frequency. General project data quality indicators are highlighted below:

- Precision – Field duplicates will be collected to assess overall precision. The precision of the data is not critical for data usability.
- Accuracy – Laboratory MS/MSDS will be used to assess accuracy. The primary data concern is to ensure analytical bias will not produce false negatives and that all potential contamination is accounted for in long term monitoring. Specific site contaminants need to be in the MS and should be within laboratory control limits.
- Representativeness – Data need to be representative of the areas of potential contamination at the site. Trip and laboratory blanks will be used to assess field and laboratory background. No project contaminants should be present.
- Completeness – A completeness objective of 90% is set for all samples except the site contaminants. The site contaminants have a completeness objective of 95%.
- Comparability – The ability to effectively compare data to historical results and clean-up criteria is important. Data needs to be generated from the same analytical methods and have the same reporting limits. The ability to compare data to specific guidance values is critical for evaluating long term monitoring data.
- Sensitivity - Sensitivity is expressed as the lowest concentration that can be distinguished from background with a given level of confidence. The quantitation limits (QLs) are presented in Worksheet #15. The QLs achieved on individual samples will vary in accordance specific sample analysis. QLs are elevated when dilutions are performed or reduced sample volume is analyzed.

Laboratories must comply with the QC limits and requirements in the referenced SOPs. The laboratories using this test must comply with the limits in this guidance. The following tables are a general overview of the QC acceptance criteria.

## QC Sample Summary Inorganics

**Matrix: Sediment/Water**
**Analytical Group or Method: CLP Routine ISM02.3 for Inorganics**
**Concentration Level: Low**

| QC Sample or Measurement Performance Activity | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Title/Position of Person Responsible for Corrective Action | Measurement Performance Criteria |
|---|---|---|---|---|---|
| Equipment Blank | 1 per 20 samples or 5% | One-half the reporting limits. The concentrations of common laboratory contaminants shall not exceed the reporting limit. | Associated sample results are qualified non-detect if less than 5 times the blank level. Changes in field procedures should be implemented if compounds are not common laboratory contaminants. | Project Chemist / Data Validation Chemist | No target analyte concentration > ½ LOQ. |
| Field Duplicate | 1 per 20 samples or 5% | RPD ≤ 20% for water (see Worksheet 12)<br><br>RPD ≤ 50% for soil (see Worksheet 12) | Associated sample results are qualified with J if noncompliant. Changes in field procedures should be implemented if a high degree of variability if found. | Project Chemist / Data Validation Chemist | RPD must be calculated as a comparison of measured concentrations. See Worksheet #12. |
| MS | 1 per 20 samples or 5% | 75 – 125% R | Flag outliers, except when the sample and/or duplicate concentration is greater than 4 times the spike concentration | Laboratory Analyst | For evaluation and acceptance criteria, see EPA ISM02.3. |
| Duplicate (DUP) | 1 per 20 samples or 5% | RPD ≤ 20% | Flag outliers, except when the sample and/or duplicate concentration is less than 5 times the CRQL. | Laboratory Analyst | For evaluation and acceptance criteria, see EPA ISM02.3. |
| Post-Digestion Spike (PDS) | After any analyte (except Ag) fails spike recovery. | 75 – 125% R | Flag outliers | Laboratory Analyst | For evaluation and acceptance criteria, see EPA ISM02.3. |
| Interference Check Sample (ICP Only) | Beginning of each run. | Within ± (CRQL + true value) or ± 20% of true value, whichever is greater. | Check calculations and instruments, reanalyze affected samples. | Laboratory Analyst | For evaluation and acceptance criteria, see EPA ISM02.3. |

## QC Sample Summary Inorganics

**Matrix: Sediment/Water**
**Analytical Group or Method: CLP Routine ISM02.3 for Inorganics**
**Concentration Level: Low**

| QC Sample or Measurement Performance Activity | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Title/Position of Person Responsible for Corrective Action | Measurement Performance Criteria |
|---|---|---|---|---|---|
| Laboratory Control Sample | 1 per batch | 70 – 130% R for all analytes except for Sb and Ag, which are 50 – 150% R.1 | Suspend analysis until source rectified; re-digest and re-analyze affected samples. | Laboratory Analyst | For evaluation and acceptance criteria, see EPA ISM02.3. |
| Method Blanks | 1 per batch | Below CRQL | Suspend analysis; re-extract and reanalyze blank and affected samples | Laboratory Analyst | No target analyte concentration > ½ LOQ. |

## QC Sample Summary SVOCs

**Matrix: Sediment/Water**
**Analytical Group or Method: CLP Routine SOM02.3 for SVOCs**
**Concentration Level: Low**

| QC Sample or Measurement Performance Activity | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Title/Position of Person Responsible for Corrective Action | Measurement Performance Criteria |
|---|---|---|---|---|---|
| Equipment blank | 1 per 20 samples or 5% | One-half the reporting limits. The concentrations of common laboratory contaminants shall not exceed the reporting limit. | Associated sample results are qualified non-detect if less than 5 times the blank level. Changes in field procedures should be implemented if compounds are not common laboratory contaminants. | Project Chemist / Data Validation Chemist | No target analyte concentration > ½ LOQ. |
| Field Duplicate | 1 per 20 samples or 5% | RPD ≤ 50% (see Worksheet 12) | Associated sample results are qualified with J if noncompliant. Changes in field procedures should be implemented if a high degree of variability if found. | Project Chemist / Data Validation Chemist | RPD must be calculated as a comparison of measured concentrations. See Worksheet #12. |
| MS/MSD | 1 per 20 samples or 5% | Percent recovery is calculated for spiked compounds and RPD is calculated for spike duplicates. Both are compared with the control limits in EPA SOM02.3. (see Worksheet 12). | Flag Outliers | Laboratory Analyst | Percent recovery is calculated for spiked compounds and RPD is calculated for spike duplicates. Both are compared with the control limits in EPA SOM02.3. |
| DMC Spikes | 1 per sample | Percent recovery is calculated for spiked compounds and compared with the control limits in EPA SOM02.3. (see Worksheet 12). | Check calculations and instruments, re-extract and reanalyze affected samples. | Laboratory Analyst | For evaluation and acceptance criteria, see EPA SOM02.3. |
| Method Blanks | 1 per batch | Below CRQL | Suspend analysis; re-extract and reanalyze blank and affected samples | Laboratory Analyst | No target analyte concentration > ½ LOQ. |

## QC Sample Summary PCBs

**Matrix: Sediment/Water**
**Analytical Group or Method: CLP Routine SOM02.3 for PCBs**
**Concentration Level: Low**

| QC Sample or Measurement Performance Activity | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Title/Position of Person Responsible for Corrective Action | Measurement Performance Criteria |
|---|---|---|---|---|---|
| Equipment blank | 1 per 20 samples or 5% | One-half the reporting limits. The concentrations of common laboratory contaminants shall not exceed the reporting limit. | Associated sample results are qualified non-detect if less than 5 times the blank level. Changes in field procedures should be implemented if compounds are not common laboratory contaminants. | Project Chemist / Data Validation Chemist | No target analyte concentration > ½ LOQ. |
| Field Duplicate | 1 per 20 samples or 5% | RPD ≤ 50% (see Worksheet 12) | Associated sample results are qualified with J if noncompliant. Changes in field procedures should be implemented if a high degree of variability if found. | Project Chemist / Data Validation Chemist | RPD must be calculated as a comparison of measured concentrations. See Worksheet #12. |
| MS/MSD | 1 per 20 samples or 5% | Percent recovery is calculated for spiked compounds and RPD is calculated for spike duplicates. Both are compared with the control limits in EPA SOM02.3. (see Worksheet 12). | Flag Outliers | Project Chemist / Data Validation Chemist | Percent recovery is calculated for spiked compounds and RPD is calculated for spike duplicates. Both are compared with the control limits in EPA SOM02.3. |
| Surrogate Spikes | 1 per sample | Percent recovery is calculated for spiked compounds and compared with the control limits in EPA SOM02.3. (see Worksheet 12). | Check calculations and instruments, re-extract and reanalyze affected samples. | Laboratory Analyst | For evaluation and acceptance criteria, see EPA SOM02.3. |

## QC Sample Summary PCBs

**Matrix: Sediment/Water**
**Analytical Group or Method: CLP Routine SOM02.3 for PCBs**
**Concentration Level: Low**

| QC Sample or Measurement Performance Activity | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Title/Position of Person Responsible for Corrective Action | Measurement Performance Criteria |
|---|---|---|---|---|---|
| Laboratory Control Sample | 1 per batch | The concentration of the spiked compounds shall be at or below the midpoint of the calibration range. Percent recovery is calculated for spiked compounds and compared to the control limits in EPA SOM02.3 (see Worksheet 12). | Check calculations and instruments, re-extract and reanalyze affected samples. | Laboratory Analyst | For evaluation and acceptance criteria, see EPA SOM02.3. |
| Method Blanks | 1 per batch | Below CRQL | Suspend analysis; re-extract and reanalyze blank and affected samples | Laboratory Analyst | No target analyte concentration > ½ LOQ. |

## QC Sample Summary - TOC

**Matrix: Sediment**
**Analytical Group or Method: DESA SOP C-88 for TOC**
**Concentration Level: Low**

| QC Sample or Measurement Performance Activity | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Title/Position of Person Responsible for Corrective Action | Measurement Performance Criteria |
|---|---|---|---|---|---|
| Field Duplicate | 1 per 20 samples or 5% | RPD ≤ 50% | Associated sample results are qualified with J if noncompliant. Changes in field procedures should be implemented if a high degree of variability if found. | Project Chemist / Data Validation Chemist | RPD must be calculated as a comparison of measured concentrations. See Worksheet #12. |
| Laboratory Duplicate | All samples are analyzed in duplicate. | RPD ≤ 50% | If %RPD is greater than 50%, rerun the sample once for confirmation. If the results of three or more analyses is outside criteria, qualify data accordingly. | Laboratory Analyst | For evaluation and acceptance criteria, see DESA SOP C-88. |
| BS/BSD | 1 per batch | % Recovery 75-125%<br>RPD ≤ 25% | Check calculations and instrument, reprepare and reanalyze samples. If samples cannot be reprepared, the affected samples must be qualified. | Laboratory Analyst | For evaluation and acceptance criteria, see DESA SOP C-88. |
| ICB/CCB | 1 per batch | Below CRQL | No action is required for sample results ≥10X the amount found in ICB/CCB. If sample results are ≤10X the amount found in ICB/CCB, the sample should be reprepared and reanalyzed. | Laboratory Analyst | No blank detection. |

## QC Sample Summary – Grain Size

**Matrix: Sediment**
**Analytical Group or Method: DESA SOP BIO 8.2 for Grain Size**
**Concentration Level: Low**

| QC Sample or Measurement Performance Activity | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Title/Position of Person Responsible for Corrective Action | Measurement Performance Criteria |
|---|---|---|---|---|---|
| Field Duplicate | 1 per 20 samples or 5% | RPD ≤ 30% | Associated sample results are qualified with J if noncompliant. | Project Chemist / Data Validation Chemist | See Worksheet #12. |
| Laboratory Duplicate | 1 per 20 samples or 5% | RPD ≤ 30% | Associated sample results are qualified with J if noncompliant. | Laboratory Analyst | See Worksheet #12. |
| Quality Control | All samples | All fractions should add up to 100%. | Check calculations, reanalyze the sample if necessary. | Laboratory Analyst | See Worksheet #12. |

## QAPP Worksheet #29 – Project Documents and Records

### Project Documents and Records

| Record | Generation | Verification | Storage Location/Archival |
|---|---|---|---|
| **Sample Collection and Field Records** | | | |
| Field Logbooks | Field Team Leader | CTI Project Manager | Project File |
| Daily Field Reports | Field Team Leader | CTI Project Manager | Project File, also submitted to USACE daily. |
| Field Adjustment Forms | Field Team Leader | CTI Project Manager | Project File, submitted to USACE for pre-approval. |
| Field Forms | Field Team Leader | CTI Project Manager | Project File |
| Photographs | Various field team members. | CTI Project Manager | Project File |
| Sample Summary Reports | Sample Manager | CTI Field Team Leader | Project File |
| COC | Various Team Members | CTI Project Manager | Project File |
| Airbill and Shipping Documents | Various Team Members | CTI Project Manager | Project File |
| CLP Trip Reports | Field Team Leader | CTI Project Manager | Project File |
| SI Report | Various Team Members | CTI Project Manager | Project File |
| HRS Documentation | Various Team Members | CTI Project Manager | Project File |
| **Project Assessments** | | | |
| Field Audits | Project Manager | CTI Program Manager | Project File, also submitted to EPA. |
| Data Validation Report | Data Validation Chemist | EPA Project Manager | Project File, also included in data summary report. |
| Data Evaluation Report | Data Validation Chemist | EPA Project Manager | Project File, also submitted to EPA. |
| **Laboratory Records[1]** | | | |
| Laboratory Data Review Checklists | Laboratory Project Managers | EPA Data Validation Chemists | Project File |
| Sample Receipt Report | Laboratory Project Managers | EPA Data Validation Chemists | Project File |
| Completed Chain-of-Custody | Laboratory Project Managers | EPA Data Validation Chemists | Project File |
| Electronic Data[2] | Laboratory Project Managers | EPA Data Validation Chemists | Project File |
| Raw Instrument Data | Laboratory Project Managers | EPA Data Validation Chemists | Project File |
| Corrective Action Reports | Laboratory Project Managers | EPA Data Validation Chemists | Project File |

## Project Documents and Records

| Record | Generation | Verification | Storage Location/Archival |
|---|---|---|---|
| Internal Audit Reports | Laboratory Project Managers | EPA Data Validation Chemists | Project File |

[1] Laboratory reports will be formatted consistent with the contract requirements.

[2] Laboratory electronic data reports will be formatted consistent with EPA Region 2 Multimedia Electronic Data Deliverable (MEDD) standard format.

## QAPP Worksheet #31, 32, & 33 – Assessments and Corrective Action

The type, frequency, and responsible parties of planned assessment activities that will be performed for the project are identified below.

| Assessment Type | Responsible Party & Organization | Number/ Frequency | Estimated Dates | Assessment Deliverable | Deliverable Due Date |
|---|---|---|---|---|---|
| Deliverable Review | Matthew Jerue, PM (CTI)<br>Robert Stenson, Technical Lead (CTI)<br>Jeffery Cange, QC Officer (CTI) | Prior to each report | Varies by document | Varies by document | Varies by document |
| Field Inspections | Matthew Jerue, PM (CTI)<br>Robert Stenson, Technical Lead (CTI) | Sediment Sampling | First week of sampling | Field Logbook / Field Forms | 7 days following completion of inspection |
| Health & Safety Audit | | Once during project | Project midpoint | H&S Audit Checklist | 7 days following completion of H&S Audit |
| Data Validation Findings | EPA Data Validation Chemist, CTI Project Chemist | Based on deficiency | 14 days from receipt of data package | Data Validation Memo | 14 days from receipt of last laboratory package |
| Peer Review | Matthew Jerue, PM (CTI)<br>TBD (CTI) | 1/Prior to report submittal | Varies by document | Hard copy or electronic mark-up of deliverable | 48 hours for response |
| Field Report | Phillip Riley, FTL (CTI) | Daily | Daily | Field Report | Emailed the following morning |
| Data Evaluation Report | Project Chemist (CTI) | One per sampling event | 30 days from receipt of data validation memos | Report | 30 days from completion of data validation |

*Laboratories are audited by applicable federal agencies and certified and accredited by the agencies.

## QAPP Worksheet #34 – Data Verification and Validation Inputs

The data verification scheme is outlined below. The table identifies the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. Data verification is a check that specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records are available to proceed to data validation. Data validation is the evaluation of conformance to stated requirements.

**Data Verification and Validation Inputs**

| Item | Description | Verification (completeness) | Validation (conformance to specifications) |
|---|---|---|---|
| **Planning Documents/Records** | | | |
| 1 | Approved QAPP | X | |
| 2 | Contract | X | |
| 3 | Field Procedures | X | |
| 4 | Laboratory SOPs | X | |
| **Field Records** | | | |
| 5 | Field logbooks | X | |
| 6 | Field Forms | X | |
| 7 | Chain-of-Custody forms | X | |
| 8 | Sampling diagrams/surveys | X | |
| 9 | Relevant correspondence | X | |
| 10 | Change orders/deviations | X | |
| 11 | Field audit reports | X | |
| 12 | Field adjustment forms | X | |
| 13 | QC Field Sample Results | X | X |

## Data Verification and Validation Inputs

| Item | Description | Verification (completeness) | Validation (conformance to specifications) |
|---|---|---|---|
| **Analytical Data Package** | | | |
| 13 | Cover sheet (laboratory identifying information) | X | X |
| 14 | Case narrative | X | X |
| 15 | Internal laboratory chain-of-custody | X | X |
| 16 | Sample receipt records | X | X |
| 17 | Sample chronology (i.e. dates and times of receipt, preparation, and analysis) | X | X |
| 18 | Communication records | X | X |
| 19 | LOD/LOQ establishment and verification | X | X |
| 20 | Standards traceability | X | X |
| 21 | Instrument calibration records | X | X |
| 22 | Definition of laboratory qualifiers | X | X |
| 23 | Results reporting forms | X | X |
| 24 | QC sample results | X | X |
| 25 | Corrective action reports | X | X |
| 26 | Raw data | X | X |
| 27 | Electronic data deliverable | X | X |

## QAPP Worksheet #35 – Data Verification Procedures

The processes that will be followed to validate project data is described below:

**Data Verification Procedures**

| Records Reviewed | Requirement Documents | Process Description | Responsible Person, Organization |
|---|---|---|---|
| Field logbook | QAPP | Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented. | Daily – Field Team Leader / Technical Lead<br><br>At conclusion of field activities - Project Manager |
| Chain-of-custody forms | QAPP, Scribe Manual | Verify the completeness of chain-of-custody records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors. | Daily - Field Team Leader / Field Sample Manager<br><br>At conclusion of field activities – Data Validation Chemist |
| Laboratory Deliverable | QAPP, Data Validation SOPs | Review EDD and ensure it is accurate with the hard copy deliverable from the laboratory. Validation of the data according to National Functional Guidelines, or EPA Region 2 guidance as applicable. | EPA Region 2<br>Data Validation Personnel with contractor support |
| Corrective Action Reports | QAPP | Verify that for any deficiencies noted, verify that corrective action was implemented according to plan. | CTI Project Manager |

## QAPP Worksheet #36 – Data Validation Procedures

The criteria used to validate the data are based on the laboratory-specific QC limits. Worksheet 36 provides an overview of the planned validation criteria for each matrix and analytical group.

### Data Validation Summary Tables

| Step IIa/IIb | Matrix | Analytical Group | Concentration Level | Validation Criteria | Data Validator |
|---|---|---|---|---|---|
| IIa / IIb | Sediment/Aqueous | Inorganics | Low | EPA Region 2 Data Validation *SOP NO. HW-2a, Revision 15, ICP-AES Data Validation, SOP NO. HW-2b, Revision 15, ICP-MS Data Validation,* and *SOP NO. HW-2c, Revision 15, Mercury and Cyanide Data Validation* | EPA Region 2 Data Validation Personnel with contractor support |
| IIa / IIb | Sediment/Aqueous | SVOCs | Low | EPA Region 2 Data Validation *SOP NO. HW-35, Revision 2, Semivolatile Data Validation* | EPA Region 2 Data Validation Personnel with contractor support |
| IIa / IIb | Sediment/Aqueous | PCBs | Low | EPA Region 2 Data Validation *SOP NO. HW-37, Revision 3, Polychlorinated Biphenyl (PCB) Aroclor Data Validation* | EPA Region 2 Data Validation Personnel with contractor support |
| IIa / IIb | Sediment | TOC | Low | Per Method SOP C-88 | DESA Data Validation Personnel |
| IIa / IIb | Sediment | Grain Size | Low | Per Method SOP BIO-8.2 | DESA Data Validation Personnel |

| **Analytical Group/Method:** | **Inorganic Compounds by CLP Routine - ISM02.3** | **Semi-Volatile Organic Compounds by CLP Routine - SOM02.3** |
|---|---|---|
| Data deliverable requirements: | Stage 3 | Stage 3 plus chromatograms |
| Analytical specifications: | Worksheet 24 | Worksheet 24 |
| Measurement performance criteria: | Worksheet 12 | Worksheet 12 |
| Percent of data packages to be validated: | 100% | 100% |
| Percent of raw data reviewed: | 10% | 10% |
| Percent of results to be recalculated: | 10% | 10% |
| Validation procedure: | EPA Region 2 Data Validation SOPs | EPA Region 2 Data Validation SOPs |
| Validation code (*see attached table): | S2bVEM | S2bVEM |
| Electronic validation program/version: | CLP EDD | CLP EDD |

| **Analytical Group/Method:** | **PCB Compounds by CLP Routine - SOM02.3** | **Total Organic Carbon by DESA SOP C-88** |
|---|---|---|
| Data deliverable requirements: | Stage 3 plus chromatograms | Stage 3 |
| Analytical specifications: | Worksheet 24 | Worksheet 24 |
| Measurement performance criteria: | Worksheet 12 | Worksheet 12 |
| Percent of data packages to be validated: | 100% | 100% |
| Percent of raw data reviewed: | 10% | 10% |
| Percent of results to be recalculated: | 10% | 10% |
| Validation procedure: | EPA Region 2 Data Validation SOPs | Method SOP C-88 |
| Validation code (*see attached table): | S2bVEM | S2bVEM |
| Electronic validation program/version: | CLP EDD | EPA Region 2 EDD |

| **Analytical Group/Method:** | **Grain Size by DESA BIO-8.2** |
|---|---|
| Data deliverable requirements: | Stage 3 |
| Analytical specifications: | Worksheet 24 |
| Measurement performance criteria: | Worksheet 12 |
| Percent of data packages to be validated: | 100% |
| Percent of raw data reviewed: | 10% |
| Percent of results to be recalculated: | 10% |
| Validation procedure: | Method SOP BIO-8.2 |
| Validation code (*see attached table): | S2bVEM |
| Electronic validation program/version: | EPA Region 2 EDD |

## Validation Code and Label Identifier Table

| Validation Code | Validation Label | Description/Reference |
|---|---|---|
| S1VE | Stage 1 Validation Electronic | EPA 540-R-08-005 |
| S1VM | Stage 1 Validation Manual | |
| S1VEM | Stage 1 Validation Electronic and Manual | |
| S2aVE | Stage 2a Validation Electronic | |
| S2aVM | Stage 2a Validation Manual | |
| S2aVEM | Stage 2a Validation Electronic and Manual | |
| S2bVE | Stage 2b Validation Electronic | |
| S2bVM | Stage 2b Validation Manual | |
| S2bVEM | Stage 2b Validation Electronic and Manual | |
| S3VE | Stage 3 Validation Electronic | |
| S3VM | Stage 3 Validation Manual | |
| S3VEM | Stage 3 Validation Electronic and Manual | |
| S4VE | Stage 4 Validation Electronic | |
| S4VM | Stage 4 Validation Manual | |
| S4VEM | Stage 4 Validation Electronic and Manual | |
| NV | Not Validated | |

## QAPP Worksheet #37 – Data Usability Assessment

The CTI Project Chemist will work with the final users of the data in performing data quality assessments. The data quality assessment may include some or all the following steps:

- Data that are determined to be incomplete or not usable for the project will be discussed with the project team. If critical data points are involved which impact the ability to complete the project objectives, the data users will report immediately to the Project Manager. The Project Manager will discuss the resolution of the issue with EPA and/or USACE technical staff and implement the necessary corrective actions (for example re-sampling);

- Data that are non-detect but have reporting limits elevated due to blank contamination or matrix interference will be compared to screening values. If reporting limits exceed the screening values, then the results will be handled as incomplete data as described above;

- Data that are qualified as estimated will be used for all project decision making. If an estimated result is close to a screening value, then there is uncertainty in any conclusions as to whether the result exceeds the screening value. The data user must evaluate the potential uncertainty in developing recommendations for the site. If estimated results become critical data points in making final decisions on the site, the Project Manager and EPA and/or USACE technical staff should evaluate the use of the results and may consider the data point incomplete.

The assessment process involves comparing analytical results to screening values and background concentrations to determine whether the contamination present is site related (i.e., above three times the background levels) or significant (i.e., above screening values).

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# QAPP Appendix A – Field Sampling Plan

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# QAPP Appendix B – Figures

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